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The CLASSIFICATION of COTTON

Miscellaneous Publication No. 310
UNITED STATES DEPARTMENT OF AGRICULTURE

The administration of the cotton acts and regulations providing for the classing, standardization, and fiber testing work explained in this publication has been delegated to the Director of the Cotton Division of the Agricultural Marketing Service. Inquiries relating to any phase of this work or to the contents of the publication should be addressed to:

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Agricultural Marketing Service
U. S. Department of Agriculture
Washington 25, D. C.

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the CLASSIFICATION of COTTON

Prepared by the Cotton Division,
Agricultural Marketing Service

A. NATURE OF COTTON AND BASIS OF ITS CLASSIFICATION

1. **The cotton fiber.**—Raw cotton, in its usual marketable form, consists of masses of fibers packaged, for convenience of handling, in bales. In a single pound of cotton there may be 100 million or more individual fibers. Although cotton fibers vary greatly in physical properties even in a pure variety of cotton, the individual fiber is the basic unit upon which spinning value depends.

Each fiber is an outgrowth of a single cell that develops in the surface layer of cells of the cottonseed. During the early stages of its growth, the fiber elongates as a thin-walled tube to its maximum length. The fiber wall is then thickened within by depositions of cellulose until it is mature. When the growth period is over, the living material dies and shrinks. The fiber then consists of a tubular wall and a central canal. When the bolls open, these fibers, which vary considerably in length and degree of wall thickening, collapse much as does the deflated inner tube of an automobile tire; and in collapsing, they become twisted about their own axes, forming what are known as convolutions (fig. 1).

2. **Botanical classification of cotton.**—Botanically, there are three principal groups of cotton that are of commercial importance. Those that have been developed in the United States from cotton native to Mexico and Central America (*Gossypium hirsutum*) are known as upland cottons and vary in staple length from about ¾ to 1½ inches. A second botanical group which is of early South American origin (*G. barbadense*) is generally of longer staple and includes Egyptian, American Egyptian and Sea-Island cottons and some of the Peruvian and Brazilian varieties. A third group embraces those shorter-stapled cottons that are native to India and eastern Asia (*G. herbaceum*).

3. **Variations in cotton quality.**—About a million farms in this country produce cotton, and in any single year much variation is found in the quality of this production. Variation occurs in the quality of cotton grown on a single farm—in fact under the system of harvesting, ginning, and packaging cotton prevailing in the United States, there usually is considerable variation within a single bale. These variations of quality result from differences in varieties planted, soils, rainfall, irrigation practices, fertilizers, temperatures, tillage methods, insect damage, length of growing season, exposure of open cotton before harvest, method of harvesting, and ginning methods.

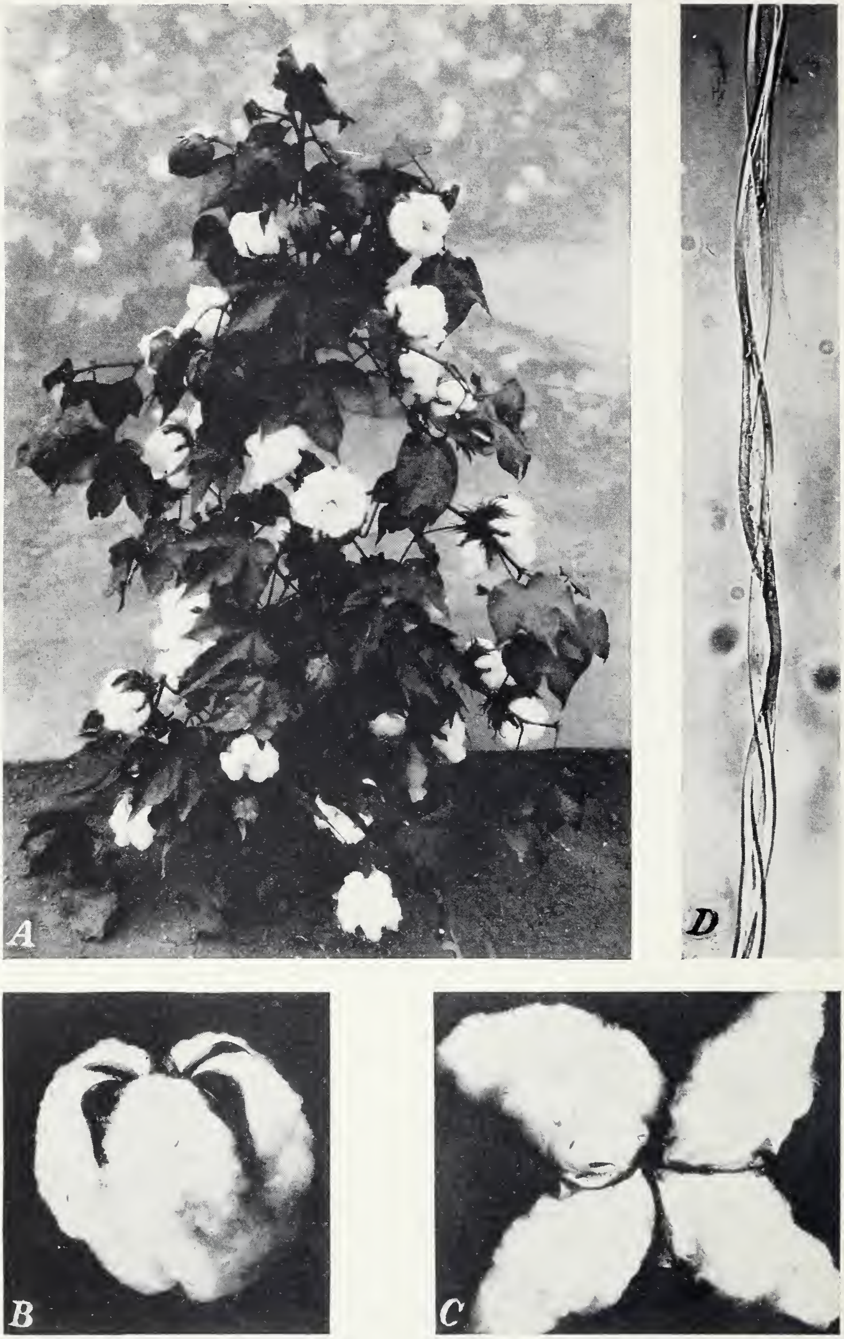

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Figure 1.—Cotton: A, on the plant; B, in the boll; C, the several locks in the boll; D, single fiber, showing wall thickness and convolutions, magnified.

Quality—as measured by such factors as length, strength, fineness, and maturity—is governed to a considerable extent by the variety and quality of the seed planted, as well as by the weather and the farming practices followed during the period in which the fibers were developed. The quality factors of color, leaf, and ginning preparation are affected to a great extent by the weather and length of exposure after the bolls open, by plant characteristics, and by harvesting and ginning practices.

4. **Classification of cotton.**—Cotton classification or classing, for purposes of this discussion, is the art of describing the quality of cotton in terms of grade and staple length according to the official cotton standards of the United States. Cotton may be classed in terms of other standards or by comparison with types; but in the United States if standards are used they must be the official standards. For grade, classification is based on appearance, and is accomplished chiefly through the sense of sight by integration of the three factors of grade—color, leaf, and preparation—in the sample. Classification for staple length involves both sight and touch and is made by pulling out and comparing a typical portion of fibers from a sample with the official standard staple types.

5. **Why cotton is classed.**—Cotton is classed to determine the grade and staple length which materially affect the spinning utility and hence the market value of each bale. In recent years the Department of Agriculture has classed for producers two-thirds to four-fifths of the cotton ginned. Farmers are interested in the classification of each bale to appraise production, harvesting, and ginning practices and to market their cotton advantageously. Classification is a means by which the cotton merchant more intelligently and efficiently buys and sells cotton. In the processing of cotton, uniformity of quality is desired. Mills require cotton that is more or less uniform in quality. Classification is essential in orderly marketing. Table 1 gives a description of American cotton bales, which are illustrated in figure 2.

TABLE 1.—*Approximate dimensions, weights, and densities of specified kinds of American cotton bales* [1]

Kind of bale	Dimensions (Approximate)	Weight (approximate)		Ties, per bale	
		Per bale	Per cubic foot		
	Inches	*Pounds*	*Pounds*	*Number*	*Pounds*
Gin, or uncompressed	56 x 28 x 45	500	12	6	9
Standard density	56 x 31 x 22	500	23	8	9
High density	57 x 22 x 21	500	33	9	9
Gin Standard density	56 x 22 x 31	500	23	10	9

[1] For further information see the following: U. S. Dept. Agr. Circular No. 736, the Packaging of American Cotton and Methods for Improvement. July 1945.

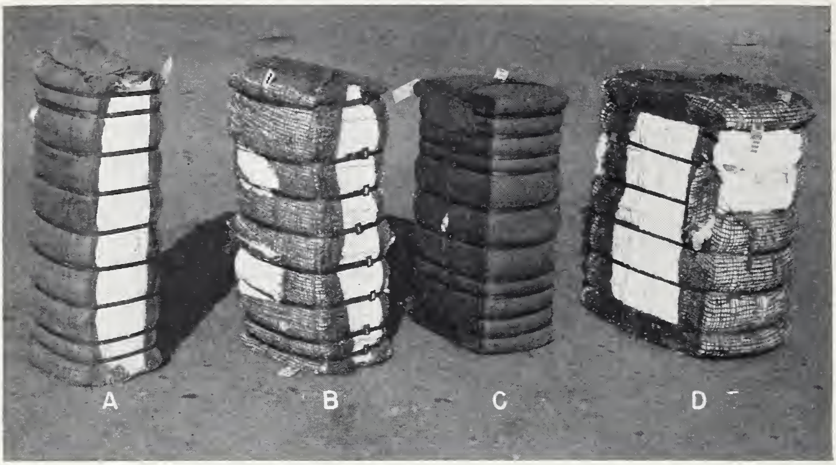

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Figure 2.—A, high-density bale: B, standard-density bale: C, ginner's compress bale: D, ginner's, or flat bale.

B. SAMPLING AND THE CARE AND HANDLING OF SAMPLES

6. **General.**—Because of the method of packaging of cotton in bales and the size of the bales, it is usually impractical for a buyer to inspect actual bales at the time of purchase. Therefore, it is general practice for market transactions to be made on the basis of samples drawn from each bale. If samples are to be satisfactory for this purpose, they must be representative of the bales from which they are drawn.

7. **Drawing of Samples.**—A sample should weigh at least 6 ounces and consist of two parts of 3 ounces each taken from opposite sides of a bale. In drawing the sample, a cut should be made deep enough to reveal a true specimen of the bale, and the face of the sample should be a minimum of 6 inches wide. A sample should never be drawn by cutting a second time into an old sample hole; samples obtained this way usually have narrow faces. If the sample is improperly drawn, too small, or the face too narrow, it is difficult to determine the correct classification.

Mechanical equipment for sampling cotton bales has been developed. This automatic sampling equipment can be used with existing gin machinery with minimum rearrangement. The mechanical sampler extracts portions of lint cotton from the lint flue at intervals during the ginning of a bale. This lint is automatically accumulated, pressed, and packaged (in a wrapper bearing gin bale number) into a 12 to 16 ounce sample designed for dividing into two samples of desirable size for classing. (Information concerning the construction and method of installation of the automatic mechanical equipment can be obtained from the Agricultural Marketing Service, U. S. Department of Agriculture, Washington 25, D. C.)

8. **Handling of Samples.**—After samples have been properly drawn, they must be handled carefully and in such a manner as to

prevent loss of leaf, sand, dust, or other material that would change their representativeness. It is also important to see that no particles of leaf, dust, or sand are dropped upon them, as they may be changed in grade by the accidental accumulation of such trash.

The useful life of a sample will depend to some extent upon its size, the care given it, and the frequency with which it is handled. After several classifications the representativeness of a sample becomes questionable.

The usefulness of a sample also depends upon the preservation of its identity. A tag or coupon showing bale number, name of gin, compress, warehouse, or other identification should be kept between the portions from the two sides of the bale.

9. **Care of Samples.**—If a sample may be needed for future reference after classification, it should be carefully wrapped or rolled so as not to mix cotton from opposite sides of the bale. Samples should not be allowed to remain open on tables as exposure to dust may cause loss of brightness, and exposure to light may cause fading.

Storing samples in heated rooms should be avoided because excessive drying and yellowing may result. Storing samples in damp places is also objectionable, as dampness may speed up the rate of increase in yellowness, and, if excessive, can cause deterioration in strength of fiber.

C. FACTORS OF GRADE

10. **Grade embraces three factors.**—Grade of cotton is composed of three factors—color, leaf, and preparation. These factors in combination constitute grade.

Color

11. **Color attributes.**—Color (as it is seen) may be described in terms of three attributes—hue, lightness, and chroma. Hue may be defined as the name of a color, as for example, yellow, red, green, or blue; lightness as the degree of lightness or darkness—on a scale of neutral colors that range from white through light and dark grays to black; and chroma as the saturation, strength, or amount of color.

For years a visual disk colorimeter that provided results in terms of hue, lightness, and chroma was used in determining the color of cotton in preparing standards for grade, but more recently a fully automatic, self standardizing, photoelectric colorimeter[1] has been developed that now replaces the visual type of instrument in cotton color determinations (see item 95).

12. **Color variations in cotton.**—In the grading of upland cotton both major and minor color differences are recognized. The major color differences are those related to the change in chroma, or degree of yellowness, as between the classes of White, Spotted, Tinged, Yellow Stained, and Gray. Gray bales contain little chroma as compared with the degree of yellowness in Tinged or Yellow Stained bales. The minor color differences are those that occur between grades of any single color class, as between Middling White and Strict Low Middling White, or within a single grade, as the difference between the brightest and dullest samples of Strict Low Middling. These minor

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[1] Nickerson, Dorothy. Color Measurements of Cotton. U. S. Dept. Agr., 38 pp., illus. March 1953.

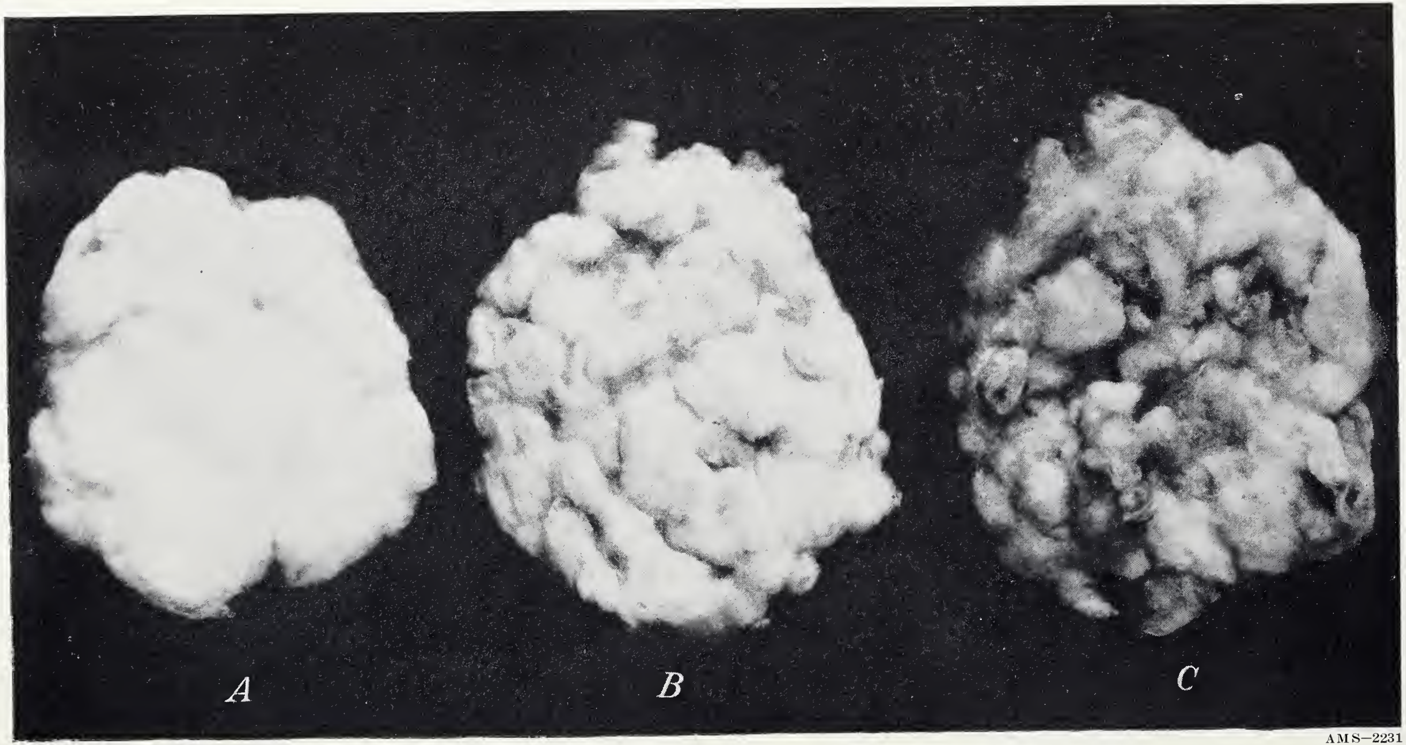

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Figure 3.—Differences in color of cotton picked from the same field: A, early; B, midseason; C, late. The cotton was ready to pick in September. The samples shown were picked during that month, mid-December and early in March.

differences are chiefly in degree of lightness; *the higher grades being lighter in color than the lower grades.* Yet, each grade also contains some chroma difference; for example, the difference between the whitest and the creamiest, or between the grayest and the most spotted sample within any one of the grade boxes.

13. **Effect of weather on color.**—In the early part of the season cotton is generally of high grade; that is to say, it is light or bright in color and if properly harvested does not carry a great amount of leaf or foreign matter. Open cotton that is left in the field exposed to the weather may become dark and dull in color and low in grade (fig. 3). Cotton from bolls that open after frost may be spotted, tinged, or yellow stained. When cotton from such bolls is picked and ginned with cotton from other bolls that have opened normally before frost, spotted cotton may result. Spots are also caused by insects and in localities of red soil, fallen or low hanging bolls may become land-stained.

Leaf and Other Trash

14. **Nature of leaf and other trash.**—Leaf includes dried and broken plant foliage of various kinds. Leaf may be divided into two general groups, (1) large leaf and (2) "pin" or "pepper" leaf. Large leaf is generally less objectionable, as large particles are more easily removed in the cotton mill by cleaning processes.

In addition to leaf, other trash and material such as stems, hulls, bark, whole seeds, parts of seeds, seed-coat fragments, motes, grass, sand, oil, and dust are sometimes found in raw cotton (see item 52).

Shale, the lining of the carpel or bur which before the opening of the boll serves to separate the locks, is extremely objectionable and difficult to remove from the lint. Motes, which are immature undeveloped seeds, are also objectionable. They vary considerably in size; some are exceedingly small whereas others are nearly as large as mature seeds. These motes at times have a number of long fibers attached that usually are thin walled. Some of the motes are crushed during ginning and the fragments of various sizes that result are scattered through the lint (fig. 4).

Fragments of *mature seed coats* are frequently found in the lint. These fragments result mainly from cutting of the seed by the teeth of the gin saw; they can be caused by maladjustment of fans, worn ribs, or improper adjustment of gin machinery. The pulling away of these large fragments is usually accompanied by separation of smaller particles of seed coat with their attached fibers. These smaller particles may be very much like neps in appearance (item 19). Also occurring in very small numbers are other neplike structures such as (1) knots formed by fibers becoming entangled around bits of foreign matter or small particles of the seed coat, (2) small fragments from seeds or motes, and (3) small yellowish fragments from diseased or insect-damaged areas which occur on the seeds.

15. **Graduation in quantities of leaf and trash.**—Leaf and trash vary in quantity through each of the grades, increasing from the high grades, in which there is little, to the lower grades, in which the proportion becomes comparatively large. Grades which contain the least proportion of leaf and foreign matter, other conditions being equal, are those with the highest spinning value.

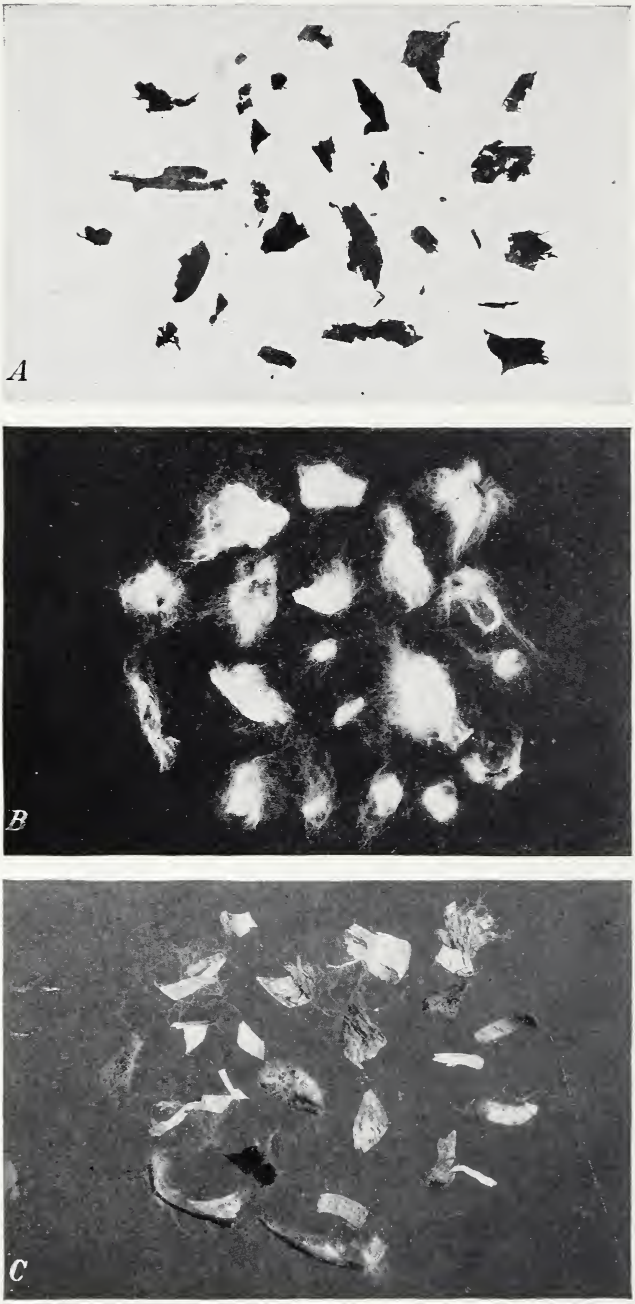

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Figure 4.—Foreign matter: A, leaf; B, motes; C, shale.

16. **Percentage of waste in different grades.**—The relative quantities of the different types of waste in the White grades vary considerably. General information is provided in table 2 for two measures of waste. One measure is provided by average percentages of the picker and card waste [2] found at the spinning laboratories of the U. S. Department of Agriculture. Another measure of waste is provided by the percentages of nonlint content as measured on the Shirley Analyzer (item 96) for bales used in the white grade standards.[3]

TABLE 2.—*Summary of total visible picker and card waste and of total nonlint content by measurement on the Shirley Analyzer*

Grade	Picker and card waste. (Average)	Shirely Analyzer (nonlint content)
	Percent	*Percent*
Good Middling	6. 3	2. 4
Strict Middling	7. 2	2. 9
Middling	8. 1	3. 7
Strict Low Middling	9. 3	5. 1
Low Middling	12. 5	7. 6
Strict Good Ordinary	15. 6	11. 0
Good Ordinary	18. 3	17. 0

Preparation

17. **Preparation defined.**—Preparation is a term used to describe the degree of smoothness or roughness with which the lint is ginned, and the relative neppiness (item 19) or nappiness (item 20) of the ginned lint.

18. **Effect of preparation on spinning utility.**—Various methods of harvesting, handling, and ginning cotton produce differences in roughness or smoothness of preparation that sometimes are very apparent. However, laboratory tests do not support the belief that these easily recognized differences in degrees of preparation in the raw cotton will follow through to produce equally important differences in spinning results. As a general rule, smoothly ginned cotton results in less waste, and produces a slightly smoother and more uniform yarn than roughly ginned cotton. Except for cases in which the roughness is excessive enough to cause the cotton to be reduced in grade materially below that of cotton having normal ginning preparation, laboratory experience does not show significantly lower results for yarn tests. Longer cottons normally will have a rougher appearance after ginning than shorter cottons, but that does not necessarily mean that yarns made from such cottons will be relatively poorer.

19. **Neps.**—Neps, in contrast to naps (item 20), are the smaller tangled knots of fibers (fig. 5) that are visible as dots or specks when a thin web of fibers is held to the light or against a dark background.[4]

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[2] U. S. Dept. Agr. Cotton Testing Service. AMS No. 16, 49 pp., illus. February 1955, p. 38.

[3] See p. 21 of publication listed in footnote 2.

[4] Pearson, Norma L. Neps in Cotton Yarns as Related to Variety, Location, and Season of Growth. U. S. Dept. Agr. Tech. Bull. 878, 18 pp., illus. 1944.

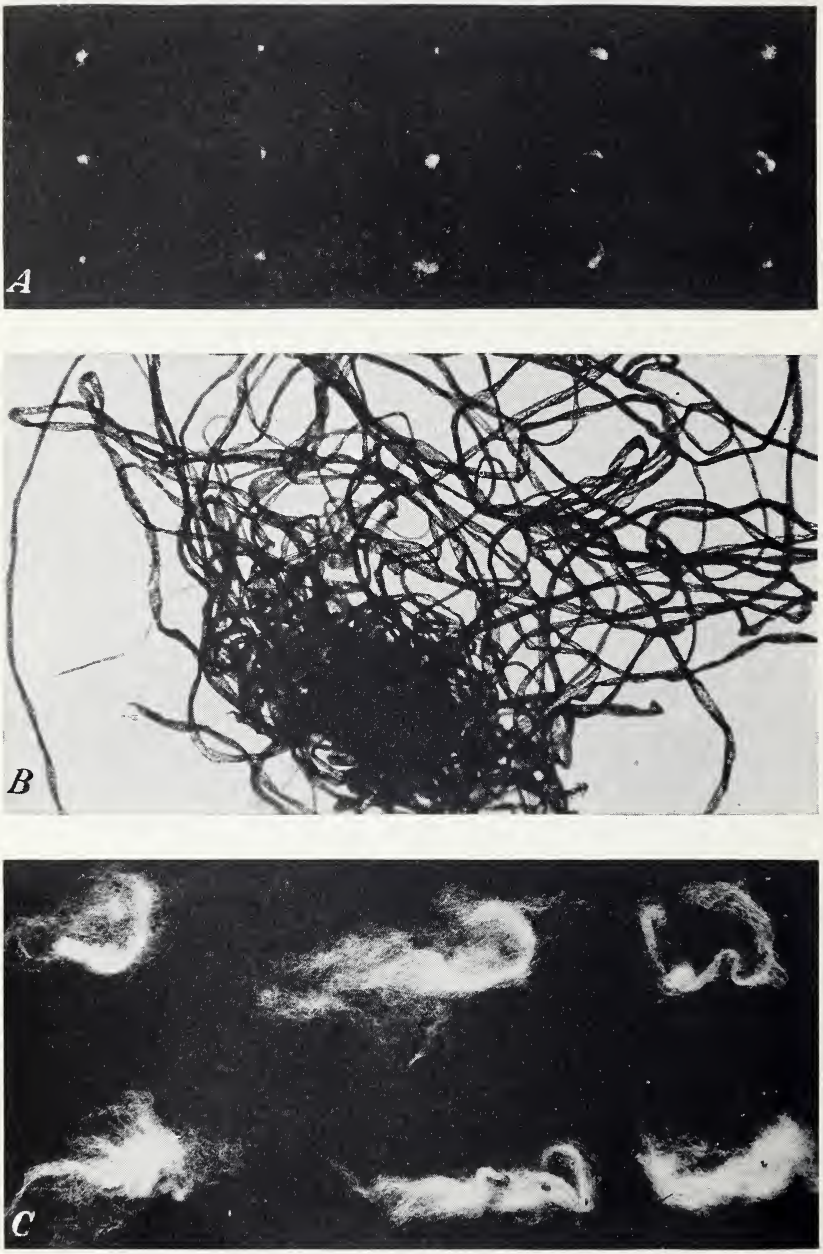

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Figure 5.—A, neps, small tangled knots of fibers that are visible as dots or specks in the lint, natural size; B, a nep seen under the microscope showing tangles of fibers, X about 70; C, naps, large and matted clumps of fibers, which contribute to the rough appearance of lint cotton, natural size.

Neps in lint are undesirable because, if not removed, they will appear as defects in the yarn and fabrics. The removal of neps from the lint is difficult, costly, and frequently impossible. The longer and finer cottons tend to be more "neppy" than the shorter, coarser cottons. Lint possessing a high percentage of thin walled immature fibers is especially likely to be neppy.

20. **Naps.**—The term "nappy" describes a lint that is rough and lumpy, and the term "nap" is applied to large clumps or matted masses of fibers that contribute to the rough appearance of ginned cotton (fig. 5). Their formation is influenced to a large extent by the condition of the seed cotton at the time of ginning, for cotton that is ginned green or wet tends to be nappy.

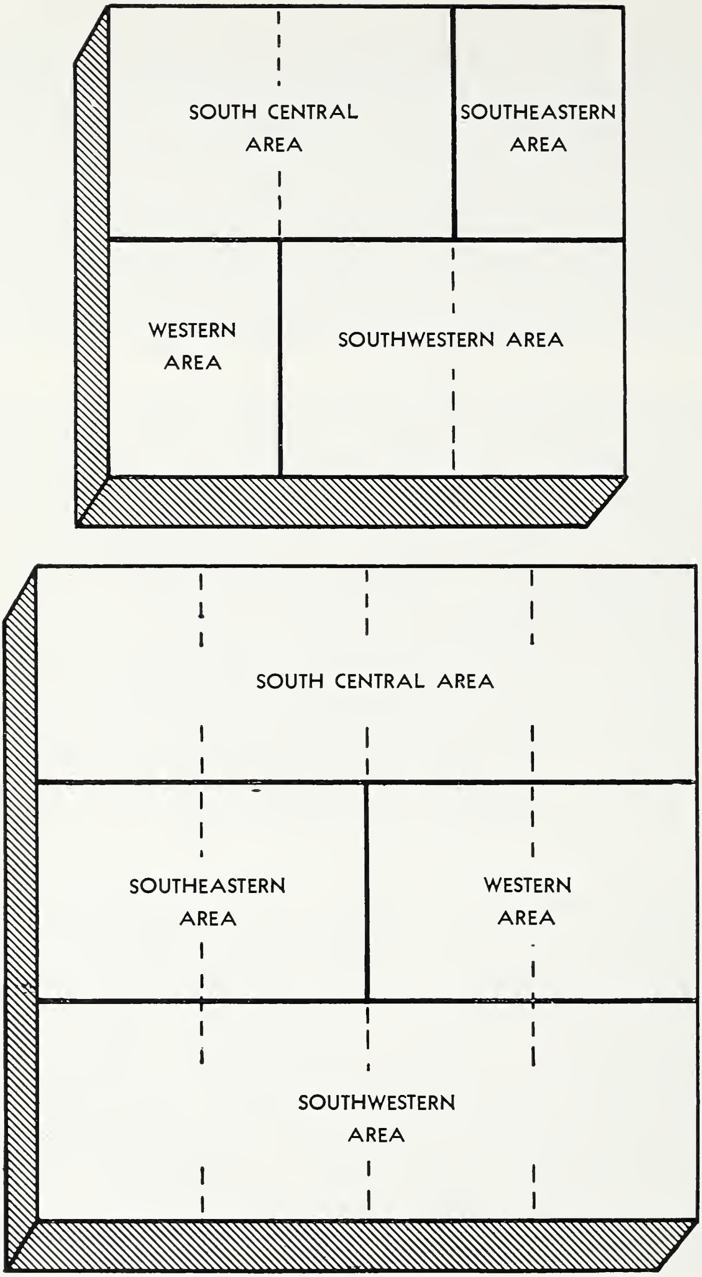
D. STANDARDS FOR GRADE

21. **Brief history of grade standards.**—The Department of Agriculture first established standards for the grade of upland cotton in 1909. These were for 9 grades of white cotton and they were never formally promulgated. The standards were entirely permissive and they were never used to any great extent in either domestic or export trade. The next grade standards issued by the Department were promulgated under the United States Cotton Futures Act of August 18, 1914 (reenacted August 11, 1916) and their use was made practically compulsory on the cotton futures exchanges in the United States on and after February 18, 1915. The United States Cotton Standards Act of March 4, 1923, gave further impetus to the cotton standardization work of the Department. The grade standards have been expanded in number and revised from time to time since the early days of standardization. They now consist of 24 grades for upland cotton, 10 grades for American Egyptian, and 11 grades for Sea-Island. In addition there are tentative standards representing three degrees of preparation of upland cotton 1⅛ inches and longer in staple for the grades Strict Middling, Middling, and Strict Low Middling.

22. **Universal standards for the grade of upland cotton.**—The 24 grades for upland cotton now in effect were promulgated by the Secretary of Agriculture on August 12, 1952, effective August 15, 1953, under the United States Cotton Standards Act and cotton futures provisions of the Internal Revenue Code. Since these standards have been agreed upon and accepted by the leading world cotton associations and exchanges they are also termed and referred to as "Universal Standards for United States Upland Cotton."

Eleven grades, namely, Good Middling White through Good Ordinary White, and Strict Middling Tinged through Low Middling Tinged, are represented in physical form by boxes of standards. The other 13 grades are descriptive. (See table 3.)

23. **Copies of standards put up in boxes.**—The originals of the standards represented in physical form are those for White and Tinged only. The original standards are sealed and deposited in a vault at the Department of Agriculture in Washington, D. C. Copies of these, known as practical forms, are prepared and sold. The range of each grade for which there are physical forms is represented by a 12-sample official box or a 6-sample guide box. Cottons representing several areas are used in each grade; for the White grades they are placed in the boxes in the positions shown in figure 6. The utmost



BN—2419

Figure 6.—Diagram of grade standards boxes, both 6- and 12-sample size to show placement in the White grade boxes of cotton from several areas. It is not always possible to follow these diagrams in the Tinged standards because cottons of all Tinged grades are not always available in each area.

TABLE 3.—*Official standards for grade of upland cotton* [1]

Gray	White	Spotted	Tinged	Yellow Stained
GM Gray	Good Middling	GM Sp	GM Tg	GM YS
SM Gray	Strict Middling	SM Sp	SM Tg	SM YS
M Gray	Middling	M Sp	M Tg	M YS
SLM Gray	Strict Low Middling	SLM Sp	SLM Tg	
	Low Middling	LM Sp	LM Tg	
	Strict Good Ordinary			
	Good Ordinary			

[1] Underlined grades are prepared for public distribution in practical forms or grade boxes. The other grades are descriptive, and are not represented by grade boxes. The grades shown above the horizontal line are deliverable on futures contracts. Those below the line are not deliverable on such contracts.

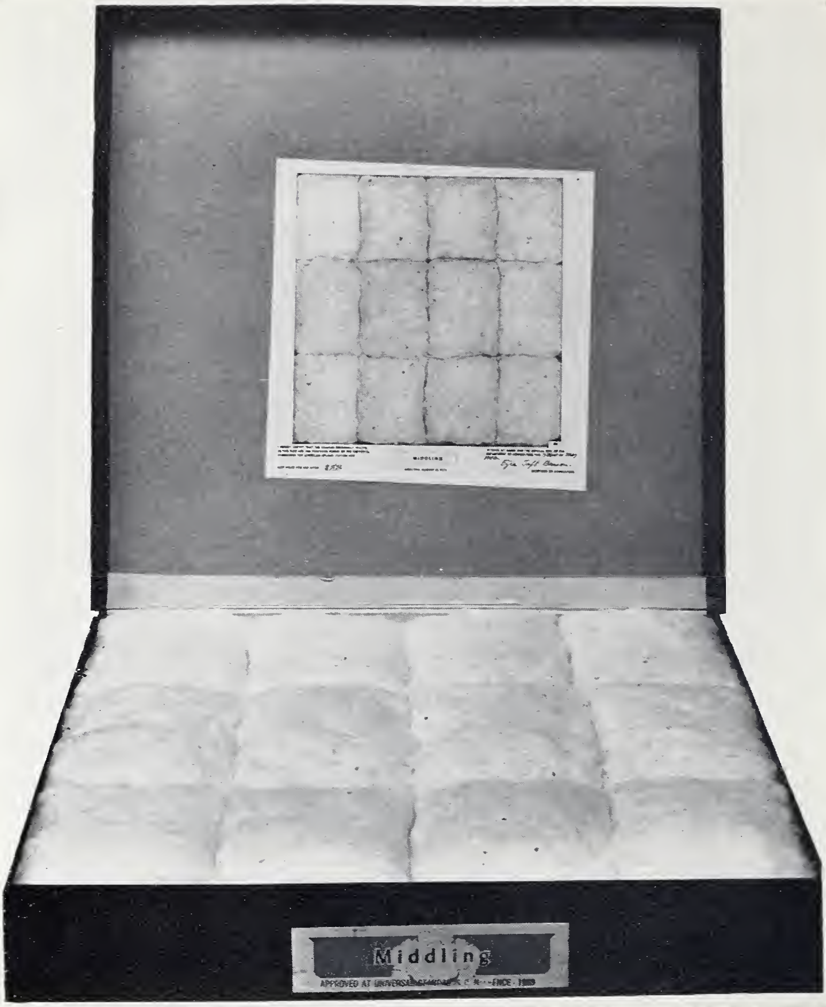
care is taken to keep the *range* of color, leaf, and preparation in all copies of each standard, whether 6 or 12 samples, as nearly the same as possible.

The color of cotton deepens with age, more in the higher grades than in the lower grades; and more in tinged cotton than in gray cotton; thus, the color in boxes stored or used under different conditions may differ considerably as time goes on. Standards kept in a cool and dry climate will not change as fast as standards kept in a hot and humid climate. Because of this natural change it is necessary to take precautions in preparing copies of the standards to keep the color at a level within the range of the original standards at the time they were established.

Each standard grade box is photographed, and the photograph is inserted in the cover of the box, as evidence of its authenticity and to make sure that the leaf is as first prepared. A comparison of the photograph with the surface of the cotton in the box should disclose whether the surface of the cotton has been disturbed or altered in any way. Thus the photograph affords protection to users of the box. Figure 7 is a photograph of a box representing the grade of Middling White cotton.

24. **Standards for five major color groups.**—The system of grades embraces both major and minor color gradations (item 12). For upland cotton the major color classifications for which there are standards are five in number—White, Spotted, Tinged, Yellow Stained, and Gray. White is the most important color because 80 to 90 percent of cotton crops of recent years have been classed White. From White there is a progressive increase of yellow color through Spotted, Tinged, and Yellow Stained. Gray grades have the leaf and preparation of corresponding White grades but have darker color. Middling Gray, for example, is Middling in leaf and preparation, but is more gray in color than Middling, but is no darker in color than Strict Good Ordinary.

25. **Grade names.**—The terms Good Middling, Strict Middling, Middling, Strict Low Middling, Low Middling, Strict Good Ordinary,

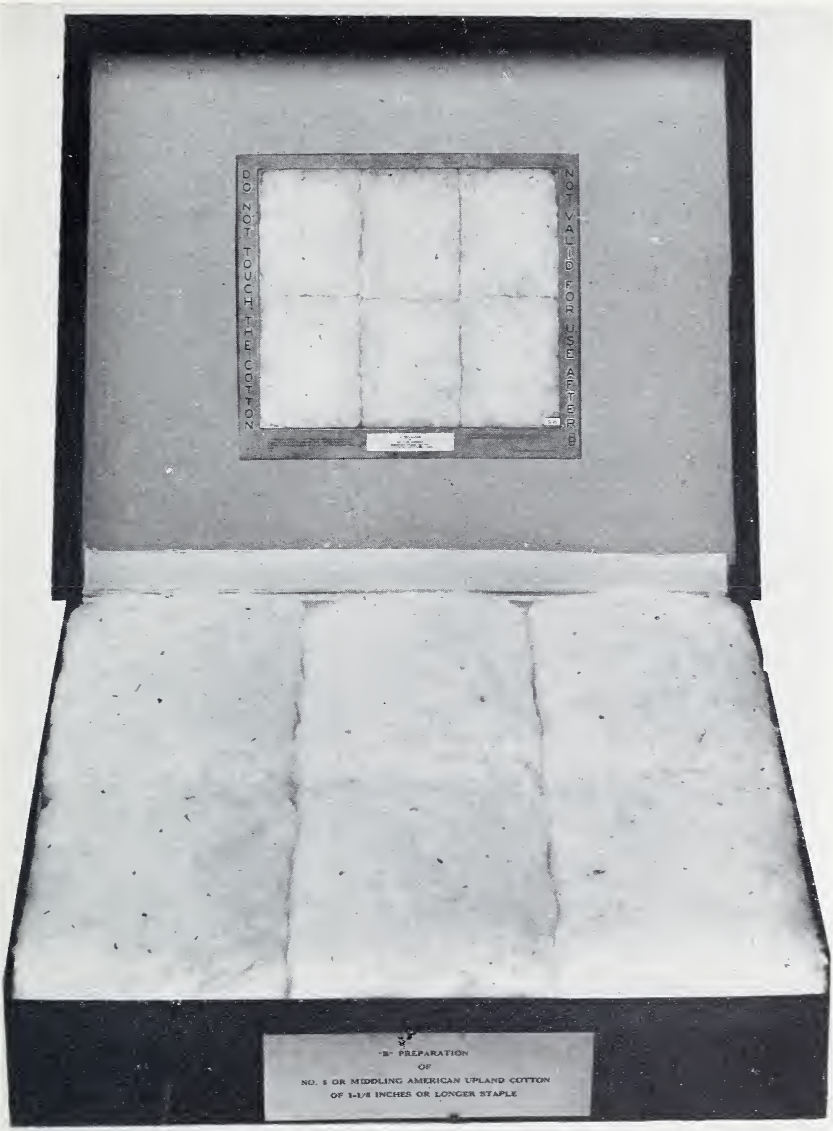


BN–2412

Figure 7.—Practical form for the grade of Middling White upland cotton. A photograph is inserted in the cover of the box to verify the preparation of the cotton and the position of the leaf. Each box carries the seal of the Department of Agriculture and the certificate and signature of the Secretary. Other grades for which practical forms are prepared are represented in the same way.

and Good Ordinary provide a scale from high to low for variation in color attributes, in leaf, and in preparation. Only the White standards cover the entire range from Good Middling through Good Ordinary.

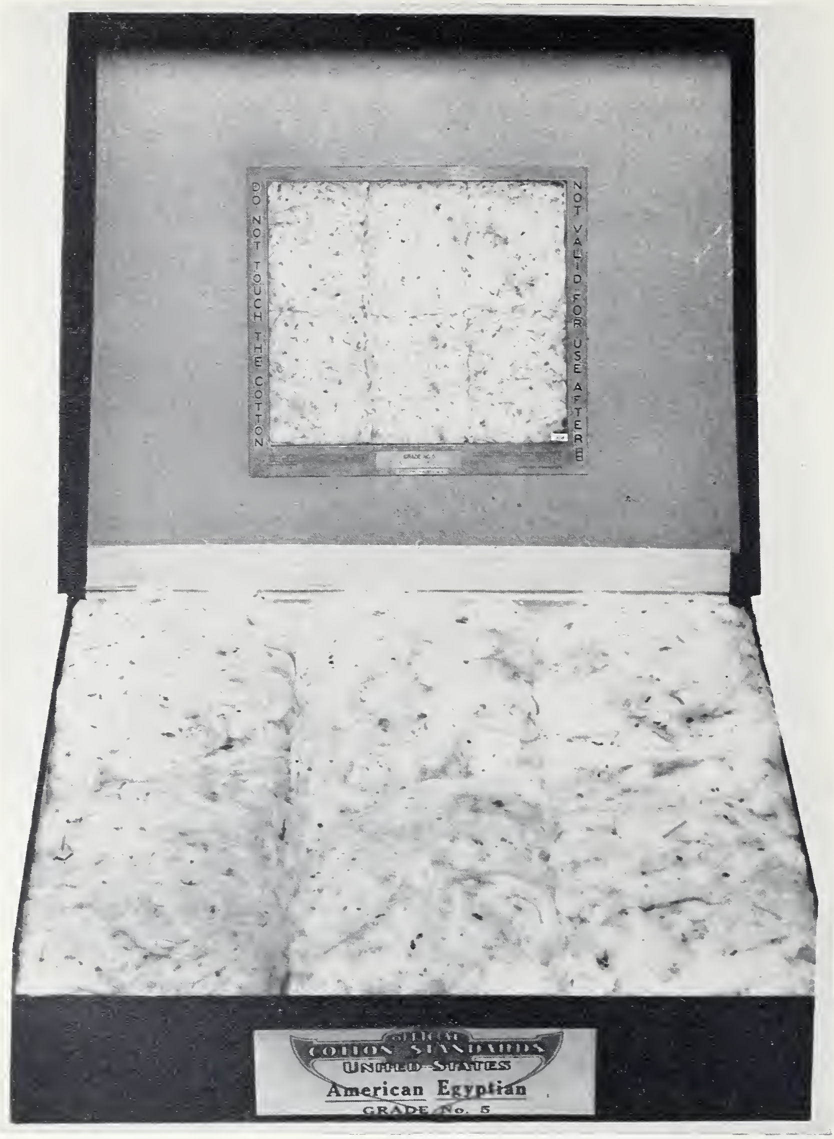
26. **Leaf and preparation in descriptive standards.**—In the standards for Spotted and Gray, the leaf and preparation equal those of the corresponding grade of White cotton, whereas the leaf and preparation of the grades of Yellow Stained are equal to the leaf and preparation of the corresponding grade of Tinged Cotton.


DO NOT TOUCH THE COTTON
NOT VALID FOR USE AFTER B
-B- PREPARATION
OF
NO. 5 OR MIDDLING AMERICAN UPLAND COTTON
OF 1-1/8 INCHES OR LONGER STAPLE

BN-2409

Figure 8.—One of the tentative standards for preparation of long-staple cotton.

27. **Tentative standards for preparation.**—Although the factor of preparation is shown in the boxes of standards for each White grade, preparation has been separately treated in the classification of the longer staples (1⅛ inches and longer) for Strict Middling, Middling, and Strict Low Middling, by the establishment of tentative standards announced in May 1929. For these tentative standards for preparation of long staple cotton there are 9 grade boxes with 6 samples in each. Figure 8 is a photograph of one of these boxes.



BN–2407

Figure 9.—Practical form of the standard for American Egyptian cotton, grade No. 5. The preparation of this cotton differs from that of short-staple cotton because it is ginned on roller gins instead of saw gins.

Three gradations of preparation—A, B, and C—were established for each of the three grades:

Preparation A is free from perceptible gin-cut fibers, neps, naps, stringy cotton, etc.; the surface of the sample is relatively smooth with the fibers laid evenly.

Preparation B is normal in roughness, the fibers showing some irregularity in their alignment with each other, and the cotton having a slight but normal amount of neps and naps. The crop of long staple cotton is predominantly B, and B is ordinarily regarded as "normal preparation for cotton having a staple length of 1⅛ inches and longer."

Preparation C shows considerably more roughness, both neps and naps being prominent throughout the sample.

28. **Grade not specified without reference to all three grade factors.**—The grade of cotton is determined in terms of color, leaf, and preparation. Color is used as a part of the grade name except for white cotton which is often specified without the color name. Middling, for example, when used by itself, refers to cotton with color, leaf, and preparation within or averaging within the range of the standard for Middling White cotton.

29. **American Egyptian and Sea-Island grade standards.**—Standards for American-Egyptian cotton are prepared in physical form in 9 grades. They are:

American-Egyptian grades No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, No. 7, No. 8, No. 9; and when such cotton is lower in grade than No. 9, it is designated as grade No. 10, which is descriptive.

Standards for sea island cotton are prepared in physical form in 6 grades. They are:

Sea-Island grades No. 1, No. 2, No. 3, No. 4, No. 5, and No. 6. There are also 5 descriptive grades which fall between those represented in physical form—namely, No. 1½, 2½, 3½, 4½, and 5½. When such cotton is lower in grade than No. 6 it is designated as "Below Grade No. 6."

30. **American Egyptian and upland grade factors differ.**—American Egyptian cotton is of a deeeper yellow color than upland cotton. The leaf content of American Egyptian standards is peculiar to this cotton and does not match that of upland standards. The preparation is very much different from the preparation for upland standards, inasmuch as American Egyptian cotton is ginned on roller gins and as seen in figure 9 looks more stringy and lumpy.

31. **Year's notice before change in standards.**—The Cotton Standards Act and cotton futures provisions of the Internal Revenue Code of 1954 both provide for one year's notice of a change or revision of the standards for either grade or staple.

E. THE DETERMINATION OF GRADE

The purpose of classifying cotton according to grade and staple is to arrive at a description of its quality, based on the official cotton standards.

32. **Importance of lighting conditions.**—The light and the position of the classer in relation to the light are important. If natural light is used—

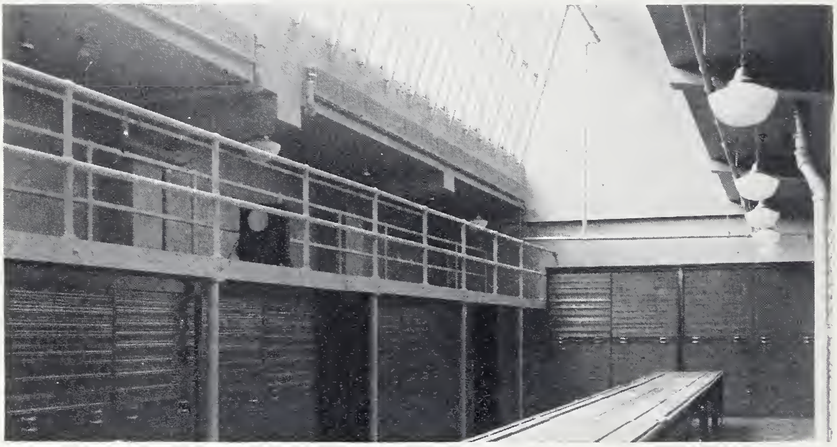
(*a*) The surrounding conditions in the room—the walls and ceiling, for example, should be observed carefully, and note made of nearby buildings to avoid reflections in the classing room from such sources.

(*b*) The tables on which the samples are laid should be placed far enough from any window to avoid any very bright light or direct sunlight.

(*c*) The classer's back should be kept to the window while he is classing, the light coming over his shoulder.

(*d*) If classing is done under a skylight, the table should be placed so as to insure a correct balance of light. The table should not be placed under the edge of the skylight opening, nor in too strong light, as either of these conditions tend to make correct classification difficult.

(*e*) In this country, light from a northern exposure is preferred, when natural daylight is used, because it provides the steadiest color of natural daylight (fig. 10).



DN–692

Figure 10.—Cotton classing laboratory equipped with skylight.

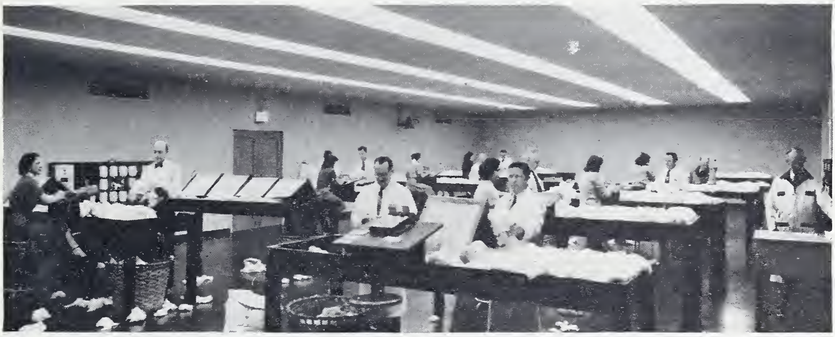
In recent years there has been a trend toward classification under artificial lighting. Large well-lighted classing rooms are now possible that were unheard of—indeed, quite impossible—prior to 1939. For many years the United States Department of Agriculture has provided leadership in setting specifications for lighting of cotton classing rooms, first under natural lighting, and more recently, under artificial lighting. Practically all classing rooms of the Department are now equipped with artificial lighting.

Although artificial lighting was tried as long ago as 1919, no real progress was made toward its use until about 1939 when a series of artificial daylighting studies were made that led to small installations of a filtered tungsten type of light in a number of Government and private classing rooms.

The initial cost and operational upkeep of the filtered tungsten type of unit in large installations placed it beyond the reach of most potential users, even though its superior technical characteristics proved satisfactory in practice. Its use, however, convinced the cotton industry of the advantage of classing under artificial lighting. To meet the need for a more economical type of lighting yet one of satisfactory color, a unit containing a combination of fluorescent tubes and filament lamps was developed.

This unit, now very widely installed in classing rooms all over the United States, originally consisted of a combination of three 40-watt daylight fluorescent (6,500° K) tubes, two 20-watt blue fluorescent tubes, and four 25-watt filament lamps placed in an enclosed mixing and reflecting chamber. More recently Examolite fluorescent tubes have been developed that combine the daylight and blue colors in one tube. This allows a newer type of unit to use four 40-watt Examolite tubes plus four new long-life tungsten lamps. With it a special type of diffusing glass is used to mix the colors at table level. These units provide a color near that which is specified[5] for the moderately overcast north sky (7,500° K), the color of which is preferred for cotton classification.

Artificial lighting of this type has proved satisfactory, particularly because it has the advantage of providing a uniform light at all times, and a greater utilization of sample room floor space (fig. 11). With such illumination it is important to have walls painted a very light gray, just off white, so as to conserve as much light as possible without producing glare, or too much contrast. Specifications for installing these lamps require a minimum of 60–80 footcandles at the classing level, and since the output of fluorescent lamps will go down about 30 percent during their normal 7,500-hour life expectancy, this level can be up to 100–110 footcandles at the time of installation. To provide this, units usually are hung, with the lower edge 10 feet from the floor, in rows that are on 7 foot centers. Surrounding conditions are important, and the following specifications are quoted from reference 4.



BN–2410

Figure 11.—Modern classing room equipped with artificial lighting.

Walls, not darker than 8.0/Munsell and preferably 8.5/Munsell;
Ceilings, not darker than 8.5/Munsell and possibly 9.0/Munsell, depending upon the height of the ceiling and structural obstructions;
Floors, about 7.0/Munsell (but satisfactory installations may be had with a black floor);
Tables, classing tables black, although gray, may be satisfactory;
Mats, on which a classer stands, should be black (so they may be used as a background for stapling).

In the Munsell scale, 9.0/ is a good white and 1.0/ a good black (10 and 0 are theoretical white and black). A flat wall paint to meet the N 8.5/ specification is commercially available, under the name of "Cotton Grading Gray."

33. **Directions for handling samples in grading.**—When lifting the sample from the table preparatory to classing, one hand, with the fingers spread slightly apart, is placed on the top side of the cotton

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[5] Nickerson, Dorothy. Cotton Classing By Artificial Light. Illuminating Engineering, Vol 47, 135–142, illus. 1952.

sample. The sample is held lightly in the hand and turned so that the other side of the sample may be clasped with the free hand and brought to a position slightly below the shoulders and about 15 to 20 inches from the eyes. This position is usually best for classing purposes. The cotton sample should be inspected for color, leaf, and preparation, while it is on the table and as it is being picked up.

To open the sample, press the thumbs lightly into the top edge and open and close the layers of cotton gently, as if they were pages of a book. As the sample is opened and closed in this manner, each layer is observed for color, leaf, and preparation.

34. **Regulations.**—The regulations of the Department of Agriculture under cotton futures legislation and the Cotton Standards Act prescribe:

(1) that the classification of all cotton samples shall be according to the official cotton standards of the United States in effect at that time;

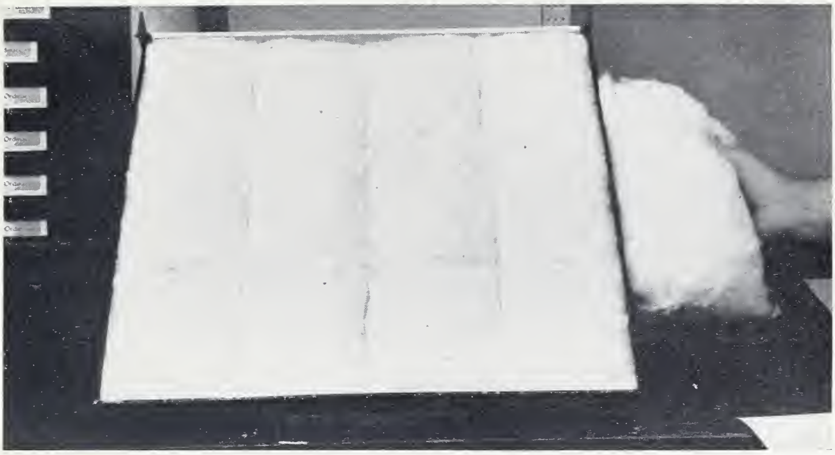
(2) that if a sample drawn from one portion of a bale is lower in grade than one drawn from another portion of such bale, except as otherwise provided in the regulations, the classification of the bale shall be that of the sample showing the lower grade; and,

(3) that if the cotton be reduced in value, by reason of the presence of extraneous matter of any character or irregularities or defects below its grade according to the official cotton standards of the United States, the grade from which and to which it is reduced, and the quality or condition which so reduces its value shall be determined and stated.

35. **Grading against boxes of standards.**—Each of the official physical standards for grade is composed of samples of cotton differing slightly in grade factors, thus creating what is called the range within each box. It is permissible to make a comparison with one of the samples in the grade box for color, another for leaf, and still another for preparation. Any cotton that possesses grade factors which come within the range of any single standard, regardless of how these factors are combined, should be classed as of that particular grade.

36. **How to compare samples with physical standards.**—To compare a sample with one of the official physical standards for grade, the sample should be rolled so as to give it a surface or face as nearly like that of the standards as possible; the sample is then held by the side of the box representing the grade in question in a position that will give the same light to both (fig. 12). In making these comparisons, the faces of the samples in the boxes should never be disturbed, and the classer should exercise care to prevent any foreign substances from falling upon the surface of the samples in the boxes. The standard boxes, when not in use, should be kept closed and should be stored in a convenient place for ready reference.

37. **Grading on descriptive standards.**—In classing samples of cotton that fall within descriptive standards for grade, comparisons should be made with the boxes of the physical standards adjacent to the sample in question. For example, if a sample appears to be Middling Spotted, it should be compared with both the Middling White and the Middling Tinged boxes to be sure that it falls between these grades for color and matches Middling White in leaf and preparation.



BN–2418

Figure 12.—Proper method of comparing sample with standards for grade. Sample is held by the side of the box in a position that will give the same light to both.

38. **Samples differing in successive "breaks."**—It often happens that different breaks or openings of a sample are unlike in color, leaf, or preparation. *The grade of the sample should not be determined by either the grade of the lowest and poorest nor the highest and best opening in the sample. After opening the sample several times, the final decision should be made by averaging the grade of all breaks or openings.* This method of classing is not meant to be used in classing two-sided bales, but should be employed in classing cotton that shows slight variations in different breaks.

If a sample shows that the bale is composed of cotton of different grades, such as Strict Middling on one side and Middling on the other side, the grade should be determined according to the cotton on the low side in accordance with regulations.

39. **Averaging factors of grade.**—Sometimes samples do not have two grade factors that fall within the range of any one grade. A sample may be Middling in color, Strict Middling in leaf, and Strict Low Middling in preparation. The general rule for averaging factors of grade is given in the order of the Secretary of Agriculture promulgating the standards for grade of upland cotton as follows:

> American upland cotton which in color, leaf, and preparation is within the range of the standards established by this subpart, but which contains a combination of color, leaf, and preparation not within any one of the standards set out in this subpart shall be designated according to the standard which is equivalent to, or if there be no exact equivalent is next below, the average of all the factors that determine the grade of the cotton: *Provided*, That in no event shall the grade assigned to any cotton or sample be more than one grade higher than the grade classification of the color or leaf contained therein.

Classers in applying this rule must average the factors of grade in terms of the official grade standards and not attempt to determine a grade of equivalent price. Price relations are continually changing and it is impossible to class cotton consistently in terms of money value. When equivalent values are determined they must be values in terms of the standards and not money values.

40. **Split grades.**—In using the standards it is permissible to describe cotton in terms of defined split grades when appropriate. For example, it may be desirable to designate a sample of cotton as Middling Plus when it has Strict Middling color and Middling leaf and preparation. Also, in the case of spotted cotton those samples that have only slightly more yellow color than the corresponding grade of white cotton may be referred to as Light Spotted; or grays may be Light Gray.

In order to facilitate classing the Department has defined various split grades. These definitions are as follows:

Plus

"*Middling Plus*" is cotton which is Middling average or better in leaf and preparation with Strict Middling or better color.

"*Strict Low Middling Plus*" is cotton which is Strict Low Middling average or better in leaf and preparation with Middling or better color.

"*Low Middling Plus*" is cotton which is Low Middling average or better in leaf and preparation with Strict Low Middling or better color.

"*Strict Good Ordinary Plus*" is cotton which is Strict Good Ordinary average or better in leaf and preparation with Low Middling or better color.

"*Good Ordinary Plus*" is cotton which is Good Ordinary average or better in leaf and preparation with Strict Good Ordinary or better color.

Light Spotted

"*Good Middling Light Spotted*" is a cotton of which the official grade is Good Middling Spotted and which has only slightly more spot or yellowish color or both than Good Middling White cotton.

"*Strict Middling Light Spotted*" is Strict Middling Spotted cotton which has only slightly more spot or yellowish color or both than Strict Middling White cotton.

"*Middling Light Spotted*" is Middling Spotted cotton which has only slightly more spot or yellowish color or both than Middling White cotton.

"*Strict Low Middling Light Spotted*" is Strict Low Middling Spotted cotton which has only slightly more spot or yellowish color or both than the Strict Low Middling White cotton.

"*Low Middling Light Spotted*" is Low Middling Spotted cotton which has only slightly more spot or yellowish color or both than Low Middling White cotton.

Light Gray

"*Good Middling Light Gray*" is cotton of which the official grade is Good Middling Gray and which has only slightly more grayish color than Good Middling White cotton.

"*Strict Middling Light Gray*" is Strict Middling Gray cotton which has only slightly more grayish color than Strict Middling White cotton.

"*Middling Light Gray*" is Middling Gray cotton which has only slightly more grayish color than Middling White cotton.

"*Strict Low Middling Light Gray*" is Strict Low Middling Gray cotton which has only slightly more grayish color than Strict Low Middling White cotton.

F. GRADING IRREGULAR AND SPECIAL-CONDITION COTTON

41. **Classification of special-condition cotton.**—Samples in which special grade conditions are found and which can be described in terms of the standards should be classified as any normal bale. As previously noted in item 34, the cotton classing regulations of the Department of Agriculture provide that cotton may be reduced in value, by reason of the presence of extraneous matter of any character or irregularities or defects below its grade according to the official cotton standards of the United States. When a reduction is made the grade from which and to which it is reduced, and the quality or condition which so reduces its value is determined and stated. These notations on classification results for bales with special grade conditions make it possible for these bales to be segregated from other bales having normal grade factors.

42. **Snapped, machine-stripped, and machine-picked cotton.**—Cotton that is snapped or harvested mechanically tends to be lower in grade and may contain more irregularities than hand-picked cotton.

Snapped cotton is gathered by hand but the entire boll is broken off the plant and the parts of the boll removed insofar as possible at the gin.

Mechanical harvesting of cotton has increased during recent years. This reflects an effort to reduce production costs.

Machine-stripped cotton is gathered by mechanical devices which strip the cotton plant from bottom to top. In addition to open cotton, immature bolls, limbs, foliage, bark, and grass gathered with the cotton are often quite difficult to remove at the gin and require special ginning equipment.

Machine-picked cotton is harvested largely by spindle-type pickers and may contain objectionable foreign matter such as grass, green leaf, and green leaf stains. An excessive amount of moistening material used for doffing the spindles and improper adjustment of the picker machinery may result in lower quality lint. Grass, such as needle grass, and other forms of extraneous matter are frequently difficult to remove from machine-picked cotton.

With the increase in hand snapping and machine picking in recent years, gins have installed additional drying and cleaning equipment for use in handling this more roughly harvested cotton. Lint cleaners are designed for cleaning lint at the gin prior to baling. These cleaners take the cotton directly from the gin stands and remove leaf, motes, and other types of trash from the lint. Excessive cleaning and over drying should be avoided as fibers may be damaged unless recommended procedures are followed in operating this equipment.

43. **Bolly cotton.**—Bolly cotton is cotton in which growth is stopped before the bolls are fully matured and, in harvesting, unopened bolls are not separated from those that are open. Instead, all bolls are gathered and carried to the gin, where they are subjected to the cleaning process, which separates the seed cotton from the bolls. The cotton then passes through the gin stand to separate the seed from the lint. Bolly cotton may be stained and will usually contain large quantities of trash such as pieces of the cotton stalk, leaves, bits of burs, and shale. The fibers of bolly cotton may be weak and irregular.

44. **Rough preparation.**—Preparation has been defined in item 17 as a term used to describe the degree of smoothness or roughness with which the lint is ginned and the relative neppiness or nappiness of the ginned lint. When a sample is reduced one or two grades because of poor preparation, the grade to which reduced, the grade from which reduced, and the notation "Prep" is entered on the classification memorandum.

Upland cotton ginned on roller gins is not comparable in appearance to the official grade standards for upland cotton which are prepared from saw ginned cotton. Spinning tests conducted by the Department of Agriculture indicate that such cotton usually contains fewer neps and naps than saw ginned cotton that is comparable in other respects. Upland cotton ginned on a roller gin is not reduced in grade for preparation unless there is definite evidence of neps and naps.

45. **Gin-cut cotton.**—Gin-cut cotton is cotton that shows damage in ginning, through cutting by the saws, to an extent that reduces the value of the cotton by more than two grades. When samples from gin-cut cotton are classed, the grade to which reduced, the grade from which reduced, and the notation "Gin-cut" is entered on the classification memorandum.

46. **Reginned cotton.**—Reginned cotton is cotton that has passed through the ginning process more than once. Cotton which in the regular process of ginning seed cotton passes over or through saws, as in a lint cleaner, in a continuous operation on its way to the gin condenser and press box, is not reginned. The rules of cotton futures exchanges in the United States provide severe penalties for any person who knowingly offers for inspection or delivery on futures contracts any cotton that has been reginned. Samples from reginned cotton are classified as other samples but the notation "Reginned" is entered immediately before the grade on the classification memorandum.

47. **Repacked cotton.**—Repacked cotton is cotton that is composed of factors', brokers', or other samples, or of loose or miscellaneous lots that have been collected and rebaled, or cotton in a bale which is composed of cotton from two or more smaller bales or parts of bales. The classification of repacked loose cotton is discouraged because loose is often so mixed that samples from different parts of the bale are likely to vary widely. If samples from repacked bales are classed, the notation "Repacked Loose" is entered immediately before the quality designation on the classification memorandum. Samples that show marked irregularity of either grade or staple are not assigned a grade or staple length and the notation "Loose-no grade or staple assigned a/c irregularity" is entered on the classification memorandum.

48. **False-packed cotton.**—False-packed cotton is cotton in a bale (1) containing substances entirely foreign to cotton; (2) containing damaged cotton in the interior with or without any indication of such damage upon the exterior; (3) composed of good cotton upon the exterior and decidedly inferior cotton in the interior, in such manner as not to be detected by customary examination, or (4) containing pickings or linters worked into the bale. If it is known that a sample is from a false-packed bale, no grade or staple length is assigned and the notation "False-Packed" is entered on the classification memorandum.

49. **Mixed-packed cotton.**—Mixed-packed cotton is cotton in a bale which, in the samples drawn therefrom, shows (1) a difference of 3 or more grades, or (2) a difference of 3 or more color gradations, or (3) a difference of 2 or more grades and 2 or more color gradations, or (4) a difference in length of staple of one-eighth inch or more. (See table 4.) If a classer determines a sample is mixed packed for grade only, the notation "Mixed Packed" is entered in the grade box or column on the classification memorandum and the staple length is entered as for any normal sample. If the sample is mixed packed for staple length only, the notation "Mixed Packed" is entered in the staple box or column on the classification memorandum and the grade is entered as for any normal sample. In any event, the two grades or two staple lengths constituting the mixture are entered in the "Remarks" space on the memorandum.

50. **Water-packed cotton.**—Water-packed cotton is (1) cotton in a bale that has been penetrated by water during the baling process, causing damage to the fiber, or (2) a bale that, although apparently dry on the exterior, through exposure to the weather or through other means has been damaged by water in its interior. If it is known that a sample is from a water-packed bale no grade or staple length is assigned and the notation "Water-Packed" is entered on the classification memorandum.

51. **Fire-damaged cotton.**—Fire-damaged cotton is cotton that has been on fire or cotton that has been damaged from the heat or smoke of a fire. If it is known that a sample is from a fire-damaged bale no grade or staple length is assigned and the notation "fire-damaged" is entered on the classification memorandum. In cases where the cotton has the appearance of being fire-damaged but there is some uncertainty as to the actual cause of damage, a grade and staple is assigned and the notation "Has appearance of fire-damage" is entered on the classification memorandum. When a sample does not reveal any fire damage but it is known that the sample is from a bale that has been reconditioned after being damaged by fire, a grade and staple is assigned and the notation "Reconditioned after fire-damage" is entered on the classification memorandum.

52. **Extraneous matter.**—Extraneous matter is any substance appearing in a cotton sample that is not discernible in the official grade standard corresponding to the quality of cotton in the sample. Such material may consist of sand, dust, oil, grass, whole seeds, parts of seeds, motes (item 14), bark, stems, etc. When cotton is reduced in grade because of the presence of extraneous matter, the grade to which reduced, the grade from which reduced, and the specific reason for the reduction is entered on the classification memorandum. The presence of grass, whole seeds, parts of seeds, motes, bark, or stems in a sample

TABLE 4.—*Mixed-Packed Cotton—Grade combinations constituting mixed packed bales are indicated by "X"*

GRADES	GRAY	GM	SM	M	SLM	WHITE	GM	SM	M	SLM	LM	SGO	GO	SPOTTED	GM	SM	M	SLM	LM	TINGED	GM	SM	M	SLM	LM	STAINED	GM	SM	M
Gray:																													
GM					X					X	X	X	X				X	X	X		X	X	X	X	X		X	X	X
SM											X	X	X					X	X		X	X	X	X	X		X	X	X
M												X	X		X				X		X	X	X	X	X		X	X	X
SLM		X					X						X		X	X					X	X	X	X	X		X	X	X
White:																													
GM					X					X	X	X	X					X	X				X	X	X		X	X	X
SM											X	X	X						X					X	X		X	X	X
M												X	X								X				X		X	X	X
SLM		X					X						X		X						X	X					X	X	X
LM		X	X				X	X							X	X					X	X	X				X	X	X
SGO		X	X	X			X	X	X						X	X	X				X	X	X	X			X	X	X
GO		X	X	X	X		X	X	X	X					X	X	X	X			X	X	X	X	X		X	X	X
Spotted:																													
GM				X	X					X	X	X	X					X	X					X	X				X
SM					X						X	X	X						X						X				
M		X										X	X														X		
SLM		X	X				X						X		X						X						X	X	
LM		X	X	X			X	X							X	X					X	X					X	X	X
Tinged:																													
GM		X	X	X	X				X	X	X	X	X					X	X					X	X				
SM		X	X	X	X					X	X	X	X						X						X				
M		X	X	X	X		X				X	X	X																
SLM		X	X	X	X		X	X				X	X		X						X						X		
LM		X	X	X	X		X	X	X				X		X	X					X	X					X	X	
Stained:																													
GM		X	X	X	X		X	X	X	X	X	X	X				X	X	X					X	X				
SM		X	X	X	X		X	X	X	X	X	X	X					X	X						X				
M		X	X	X	X		X	X	X	X	X	X	X		X				X										

NOTE.—The definition for mixed-packed cotton, as given in the cotton classing regulations of the Department of Agriculture reads as follows: "*Mixed-packed cotton*—Cotton in a bale which, in the samples drawn therefrom, shows (1) a difference of 3 or more grades, or (2) a difference of 3 or more color gradations, or (3) a difference of 2 or more grades and 2 or more color gradations, or (4) a difference in length of staple of ⅛ inch or more."

can be detected in observing the different layers of the sample in the regular grading operation.

Sand in a sample may be detected by shaking the sample gently over a piece of clean paper, but dust is not so easily detected. The presence of dust is indicated by a dull un-natural color in the cotton and may at times be detected by opening the sample and then pushing it together, thus forcing air through the sample. As the air is forced out it carries with it some of the dust which may become visible in the surrounding air.

Oil stained cotton is cotton that has become more or less saturated with oil during the ginning process. It is usually recognized by its feel and by its odor.

53. **Below Grade Cotton.**—Below grade upland cotton is lower in grade than the lowest grade of the applicable color group of the official cotton standards. When such samples are classed, the term "Below Grade" is entered in the grade space on the classification memorandum. The cotton may be further described by entering the applicable term—"Below Good Ordinary," "Below Low Middling Spotted," "Below Low Middling Tinged," "Below Middling Yellow Stained," or "Below Strict Low Middling Gray"—in the "Remarks" space on the classification memorandum.

G. INACCURACIES IN GRADING COTTON

54. **Common errors in grading.**—The establishment and distribution of physical standards to which classers can refer for guidance has done much to promote uniformity of classing. But, the usefulness of a system of classification of cotton, as of any other classification, is dependent in large part upon uniformity of application.

Cotton classing in its present state of development depends upon human perceptions of sight and touch and involves the exercise of human judgment. Thus, the grade determinations of cotton classers are subject to the inexactness and vagaries of the human factor. However, by careful study and by proper use of the grade standards many of the common inconsistencies in the classing of cotton for grade can be eliminated; and many others can be reduced, as their nature is recognized, their causes are learned, and remedies are developed.

55. **Sources of variations in grading.**—Variations in grading can be traced, in general, to four sources:

(*a*) The sample. Its homogeneity, representativeness, and, in some cases, its size and condition.

(*b*) The classer himself. His knowledge of standards and his skill in applying them, the stability or instability of his nervous system, and his susceptibility to influences such as information on previous classifications, or knowledge of conditions under which the cotton was grown, harvested, or ginned.

(*c*) The conditions under which the classing is done, that is, light, atmospheric humidity, and so on.

(*d*) Failure to examine carefully both sides of the sample.

56. **Types of variation—causes and remedies.**—Some of the common sources of variation in grading, along with causes of variation and a few suggestions as to how variations may be remedied are listed in table 5.

Table 5.—*Variations in grading—some causes and remedies*

Type of variation	Cause	Remedy
1. Bias. (a) Consistent bias-tendency of classer to be hard or easy.	1. Constitutional tendency. 2. Previous experience or training not in line with standards.	Recognition of specific tendency, along with complete knowledge of and frequent reference to the standards.
(b) Occasional bias.	1. Suggestion. 2. Prejudice. 3. Physiological or psychological condition of classer. 4. Temporary misconception of standards.	Frequent reference to the standards. Classing the samples without knowledge of source or of classification previously assigned.
2. Irregularity—erratic classification.	1. Unfamiliarity with standards. 2. Physical or nervous condition of the classer. 3. Lack of care.	Complete knowledge of and frequent use of grade standards.
3. Disregard of 1 or more of the major steps of graduation.	Incomplete knowledge of the grade scale.	Frequent study of grade standards and frequent reference to and study of classing results.
4. Tendency to group the samples toward modal group or the average of the lot.	Classing too rapidly and assuming a lack of variation between samples in the lot.	Careful examination of each sample for each of the grade factors.
5. Failure to classify both sides of sample.	Classing too rapidly or carelessly because classer thinks cotton is uniform.	Careful classification of both sides of the sample before determination of grade.
6. Tendency to spread close groups of samples into a greater number of grades than are represented.	An effect known to psychologists as "end effect" in which the ends of a series look more different than they are—e. g. in 100 bales of Middling the few best samples would be called Strict Middling and the lowest called Strict Low Middling.	Careful examination of the most widely differing samples in any group, and then comparison to standards to see that the best is not graded too high, nor the lowest is graded too low.

57. **Prior experience or knowledge of previous classification an influence.**—Some classers are influenced by the knowledge of where the cotton was grown, for example, a prejudice for or against cotton from a specific district from which they have at some time received good or poor cotton. Sometimes cotton classers are influenced by the knowledge of a previous classification, as for example, when it is known that the cotton has been classed by another as being of a certain grade or grades. In such a case a classer may subconsciously tend to look for and find these grades, whereas if he had exercised his own judgment unaffected by the judgment of another, the result might have been more accurate.

58. **Erratic classification.**—There is also a tendency for some classers to be too easy at one time and too hard at another. This may be caused by a vagueness in knowledge of the official standards. Until

a classer is thoroughly familiar with the grade and staple standards, it is impossible for him to proceed with confidence and erratic classification is likely to follow.

59. **Failure to use certain standards.**—Variation in grading sometimes occurs because of failure to refer to or use some of the official grade standards when making grade classifications. A careless or an improperly trained classer, for example, may fail to make use of the descriptive spotted grades; another may ignore gray cotton or perhaps some other particular grade-color combination.

60. **Tendency to group the samples toward one grade.**—One common inaccuracy is for the grading to be grouped toward one grade near the center of the range and not give full recognition to characteristics of each individual sample. This is caused by a lack of familiarity with the adjacent standards, or by carelessness. Cotton that should be graded Middling Light Spotted, Strict Middling Light Spotted, Strict Middling, or even Strict Low Middling may often be erroneously classed Middling.

61. **Nonrecognition of grade factors.**—Sometimes the grade factors of color, leaf, and preparation are not recognized or are appraised incorrectly, either because of too rapid classing or impaired vision, or because of lack of understanding of the relative weight of each of the grade factors, or of an inability to apply them correctly in the classification of samples.

62. **Carelessness.**—Insufficient care in examining samples for special conditions and for plated or two-sided bales is another cause of error in classification. A bale that may be Middling on one side and Strict Middling on the other may be inaccurately graded Strict Middling because in a hasty examination the Middling side was improperly inspected.

63. **Inadequate samples.**—Some variations may be traceable to classing samples that are too small to represent accurately the cotton in the bale. The class of the sample may be correct, but it may not be the true class of the bale from which the sample was drawn. Undoubtedly other differences are due to improperly conditioned, poorly handled, or excessively handled samples which are not representative of the bale.

64. **Lack of good light.**—Other errors are due to classing under poor lighting conditions, as for example, the failure to recognize spots which would have been readily recognizable under better lighting conditions.

65. **Errors can be reduced.**—Many of these errors or variations in classing can be reduced (1) if the classer will refuse to class under poor light; (2) if the classer will refuse to class small and poorly drawn samples; (3) if he will carefully examine each sample for special conditions or irregularities; (4) if he will class each sample on its merits, regardless of any previous knowledge of growth, prior classification, or other factors irrelevant to the intrinsic properties of the sample; (5) if he will weigh and properly balance the grade factors; (6) if before starting work in the morning and afternoon the classer will examine the boxes of standards representing the grades of cotton to be classed; (7) if he will classify carefully both sides of every sample; and (8) most important, if he will obtain a thorough knowledge of the official grade standards. Such knowledge can be acquired by study and by constant and continuous reference to the official grade standards.

66. **Thorough knowledge of standards necessary.**—The importance of a thorough knowledge of the official grade standards for accurate cotton grading cannot be over-emphasized. Every cotton classer should concentrate on the official grade standards and should use them until he is familiar with each one. The standards should be studied until a picture of each, as well as the set as a whole, is indelibly imprinted on the mind. These official standards are the classer's guide. It is essential that he develop an ability to state quickly and accurately the grade which most nearly matches the sample in question. This ability, once acquired, can be retained only by frequent reference to the standards. Many deviations from the standards can be avoided if cottons that are out of the range of qualities being classed are carefully compared with the standards.

H. FACTORS OF STAPLE AND THE STANDARDS FOR STAPLE

67. **Staple length defined officially.**—Staple length of cotton is defined in the original order promulgating staple standards as follows:

> The length of staple of any cotton shall be the normal length by measurement, without regard to quality or value, of a typical portion of its fibers under a relative humidity of the atmosphere of 65 percent and a temperature of 70° F.

68. **Staple length an important quality factor.**—Staple length is one of the most important factors of cotton quality because both fiber fineness and fiber tensile strength are associated with staple length in the principal varieties of cotton now in commercial production. The longer staples are usually finer and stronger than the shorter staples and are required for the manufacture of fine, strong yarns.

69. **Length of fibers in a sample.**—When fibers from a sample of cotton described as being $1\frac{5}{32}$ inches in staple length are arrayed they have been found to range from less than $\frac{1}{8}$ of an inch up to $1\frac{5}{8}$ inches in length (fig. 13). To make this array, the longest fibers were carefully selected and placed at the left of the array, and the fibers of each succeeding length were placed immediately to the right. This process was continued until the shortest fibers, shown at the extreme right of the photograph, were placed.

70. **Fibers rejected in classer's pull.**—The smooth curved line in figure 14 represents the fibers in the sample from which a pull was made, and the broken curved line is the diagram of the fibers in the pull itself. From this diagram it is easy to see which fibers were rejected and which were retained during the process of pulling or stapling. It will be observed that some of the long and some of the short fibers were disposed of, but that some of both were retained.

71. **Promulgation of official standards for staple.**—The order of the Secretary of Agriculture of October 25, 1918, promulgating the standards for staple, provides for the designation of various lengths in terms of inches and fractions of an inch from below $\frac{3}{4}$ inch upward in gradations generally of thirty-seconds of an inch to $1\frac{3}{4}$ inches, disregarding any fraction less than a thirty-second.

Since 1918 the original order has been amended from time to time. Types in physical form are available for American upland cotton of the lengths $\frac{3}{4}$,[6] $\frac{13}{16}$, $\frac{7}{8}$, $\frac{29}{32}$, $\frac{15}{16}$, $\frac{31}{32}$, 1, $1\frac{1}{32}$, $1\frac{1}{16}$, $1\frac{3}{32}$, $1\frac{1}{8}$, $1\frac{5}{32}$,

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[6] Effective June 1, 1957 types in physical form for these lengths will no longer be available.

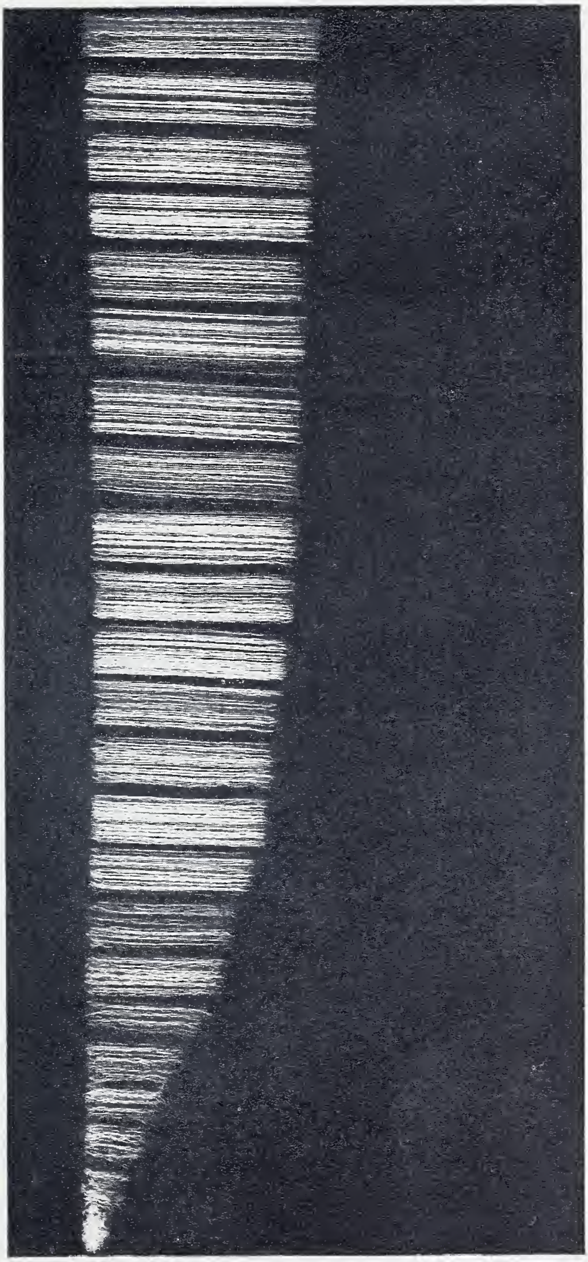

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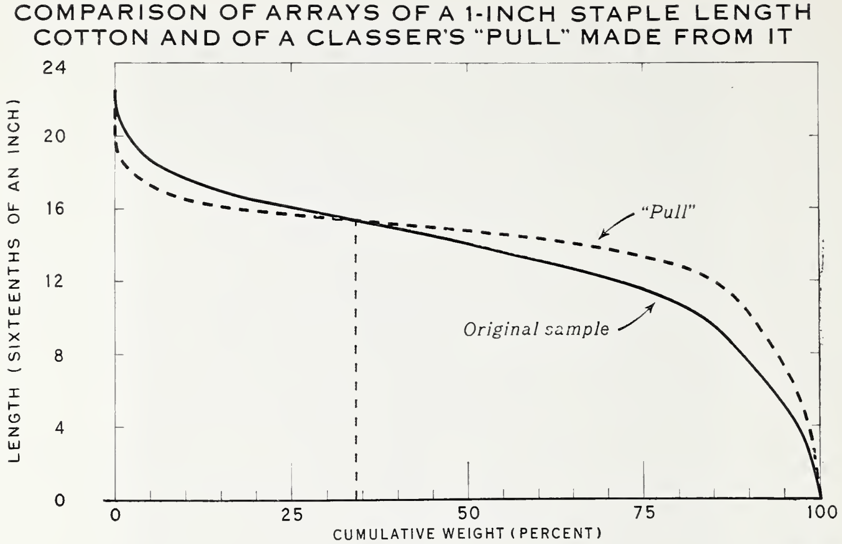
Figure 13.—An array of the fibers found in a sample of cotton called $1\frac{5}{32}$ inches in staple. The fibers range in length from less than one-eighth inch up to $1\frac{5}{8}$ inches.



BAE—32889

Figure 14.—Diagram of fiber arrays made from a classer's pull and from a sample of the bale from which the pull was made, indicating what part of the fibers the classer discarded in making his pull.

1$\frac{3}{16}$, 1$\frac{7}{32}$, 1$\frac{1}{4}$, 1$\frac{9}{32}$,[6] 1$\frac{5}{16}$, 1$\frac{11}{32}$,[6] 1$\frac{3}{8}$ and 1$\frac{1}{2}$[6] inches respectively, and for American Egyptian cotton of the lengths 1$\frac{3}{8}$, 1$\frac{7}{16}$, 1$\frac{1}{2}$, 1$\frac{9}{16}$, 1$\frac{5}{8}$, and 1$\frac{3}{4}$ inches; and Sea-Island cotton of the lengths 1$\frac{1}{2}$, 1$\frac{9}{16}$, 1$\frac{5}{8}$, and 1$\frac{3}{4}$ inches (fig. 15).

Although the linear inch is the basic standard, in determining the normal length by measurement of a typical portion of fibers in a given sample, the process of stapling is facilitated by the use of practical forms, which are also known as staple types. Because of variable atmospheric conditions and of the greater ease of comparison, the staple types are more often used in staple determination than is the linear rule. When the staple type is properly pulled under standard conditions the classer's pull will measure the length indicated on the label attached to the type.

72. **Types match original representations.**—The staple types are prepared from bales selected to match the original representation of each of these lengths. Bales are selected by classers for use in preparation of staple types as representative of the assigned length. The original representation consists in each instance of about 10 pounds of cotton stored in a vault at the Department of Agriculture in Washington. Each staple type, as prepared for sale to the public, contains approximately 1 pound of raw cotton and bears on its wrapper a statement of the standard length of staple which it is issued to represent, certified to by the Secretary of Agriculture (fig. 16).

73. **Staple types represent normal character.**—The specialists in the cotton standardization work have carefully selected the bales to be used in the preparation of staple types from cotton which they considered to be of normal character. Bales selected currently for

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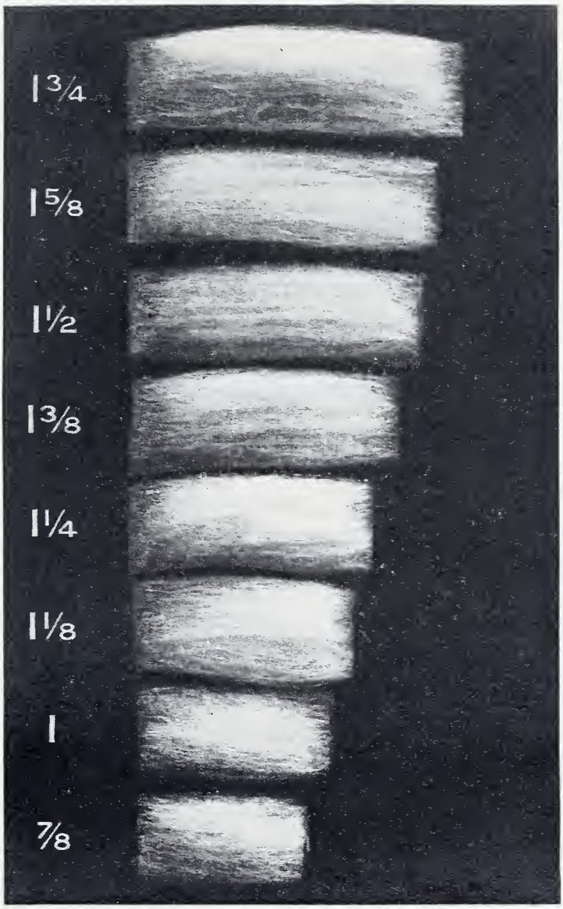
See footnote 6, p. 30.



BN–2403

Figure 15.—Staple lengths. Pulls from types representing the official standards for eight selected lengths of staple.

staple types meet laboratory specifications for length, fiber fineness, maturity, uniformity, and strength. Extremes in these factors are avoided.

I. METHOD OF STAPLING

74. **Regulations concerning stapling.**—Cotton is classified for length of staple in accordance with the official standards and the regulations[7] of the Department of Agriculture under both cotton futures legislation and the Cotton Standards Act which state: (1) that if the sample drawn from one portion of a bale is shorter in length than one drawn from another portion of the bale, except as otherwise provided in the regulations, the classification of the bale shall be that of the sample showing the shorter length; and (2) that if cotton be reduced in value by reason of irregularities or defects

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[7] Supplementary procedures for the classification of mechanically drawn samples are now in the process of development.

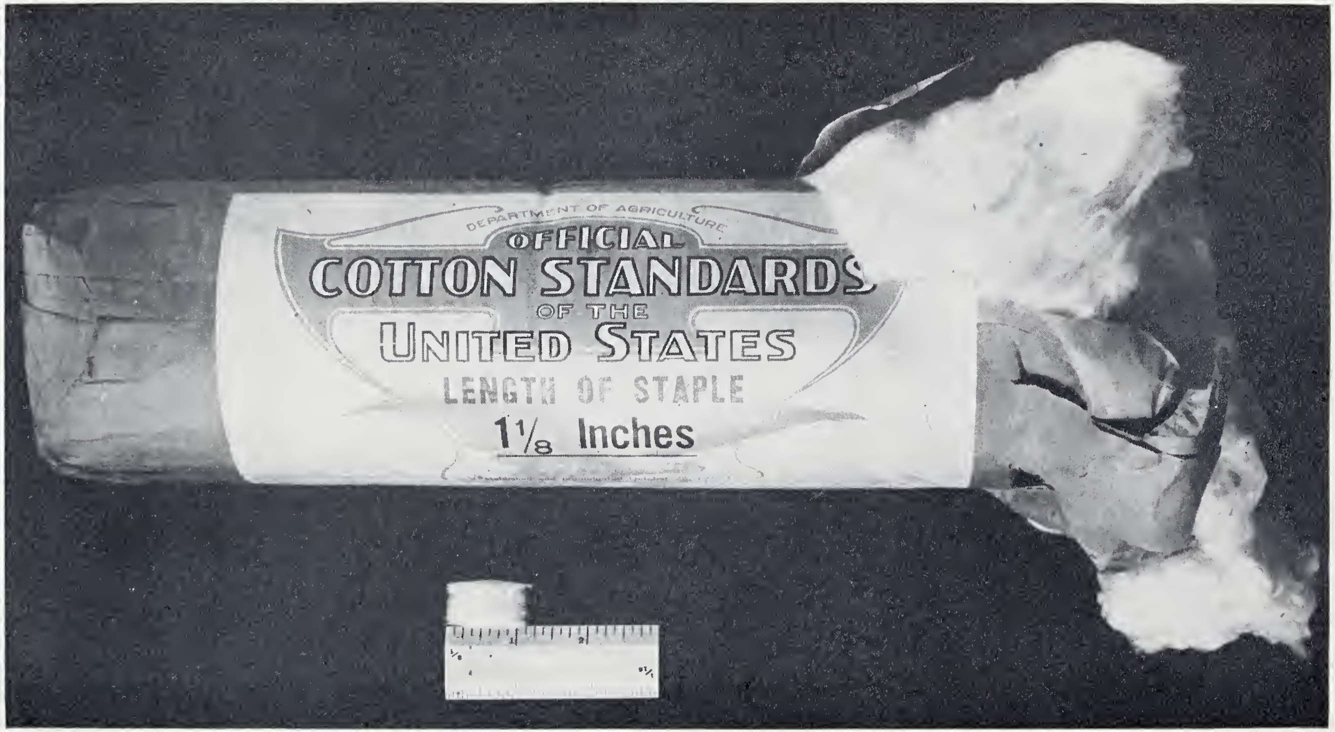

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Figure 16.—A practical form of the official cotton standard for length of staple 1⅛ inches, and a typical pull of fibers from the cotton.

below its apparent length of staple according to the official cotton standards of the United States, the length of staple from which it is so reduced and that to which it is so reduced, and the quality or condition which so reduces its value, shall be determined and stated.

75. **Practical application of the staple standards.**—In classing cotton for length of staple the classer makes what is known as a "pull." In other words, the classer pulls a tuft of fibers from the sample and by a process of lapping, pulling, and discarding, parallels a typical portion of the fibers. *A separate pull is made from the portion of the sample drawn from each side of the bale.* He then arrives at the length to be assigned to the sample by judging the length of the pulls with the eye.

If the classer is in doubt about the length of a sample, he compares his pulls from the sample with a pull from the official staple length type which he believes most nearly corresponds with the length of the sample. Classers occasionally measure the length of pulls by the use of a ruler.

Classers may make the pulls in their own individual ways or by imitation of methods used by others. They must develop the ability to repeat themselves consistently and thus match the standards.

The method of stapling varies widely but one method frequently used is as follows:

Grasp in the two hands a tuft of cotton of a size convenient for the purpose (about one-fourth of an ounce in weight), holding it firmly between the thumb and forefinger of each hand, with the thumbs placed together, the fingers being turned in toward the palms of the hands, and the middle joints of the second, third, and fourth fingers of each hand touching the corresponding joints of the fingers of the other hand, so as to give a good leverage for "breaking" the cotton (fig. 17, A).

Pull the cotton slowly with about the same leverage of each hand on the joints of the fingers, separating the tuft of cotton into two parts (fig. 17, B).

Discard the part remaining in the right hand (fig. 17, C).

Grasp with the thumb and forefinger of the right hand the end of the tuft of the cotton retained in the left hand. Draw a thin layer of fibers with the right hand. The point of pressure on the cotton in the left hand is just below the joint of the thumb and at the nail joint of the forefinger (fig. 17, D).

Retain this layer in the right hand and repeat this operation about three times, placing each successive layer directly over the fibers previously drawn, using care to see that the ends of all the layers are even with each other between the thumb and forefinger of the right hand (fig. 17, E).

After discarding the cotton in the left hand, hold the fibers thus obtained between the thumb and forefinger of the right hand and smooth and parallel them with the thumb and forefinger of the left hand (fig. 17, F and G).

Still holding the cotton between the thumb and forefinger of the right hand, draw a layer of fibers with the left hand. Retain this layer in the left hand and repeat this operation about two times, placing each successive layer over the fibers previously drawn, using care to see that the ends of all the layers are even with each other between the thumb and forefinger of the left hand. This operation

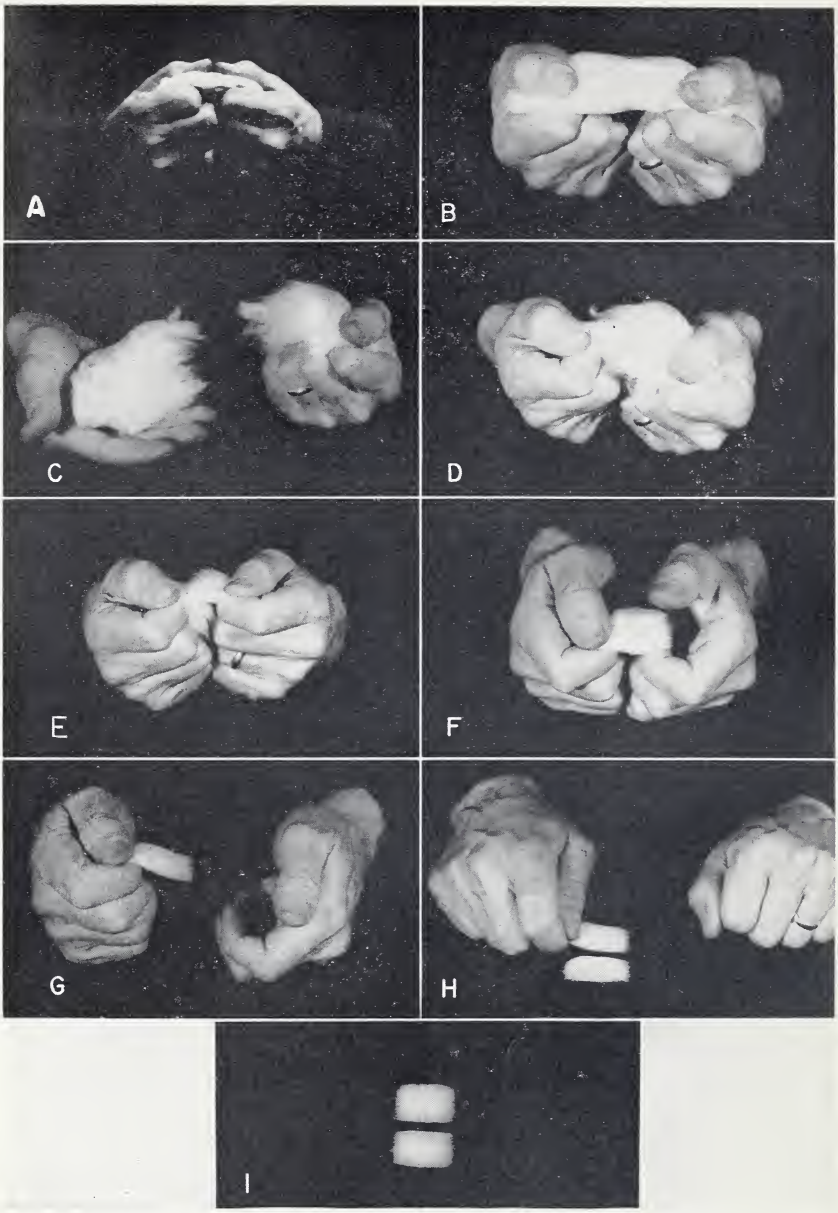


Figure 17.—Method of pulling staple. (See text for instructions.)

is the same as shown in fig. 17, E, except that the size of the tuft of fibers has been reduced and the layers of fibers are being drawn with the left hand instead of the right hand.

After discarding the cotton remaining in the right hand, the fibers on each end of the pull should be smoothed and evened off by pulling out and discarding a small percentage of fibers that exceed in length the modal group or typical pull.

If there is any question in the classer's mind at this point concerning the proper length, he should place the pull on a flat, horizontal surface preferably with a black background and compare it with a pull from the appropriate official staple type (fig. 17, H and I).

If this method is correctly and consistently followed, the length obtained should be the same for several pulls from the same cotton and should agree with that obtained by comparisons with pulls from the official staple type for that length.

76. **The "break" in pulling staple.**—In making a classer's "break," fibers are not actually broken in mass, but are pulled apart and separated from each other, in what the classer speaks of as the "break." Some classers obtain an impression of the length from the behavior of the cotton on the "break."

Since weak or irregular fibers do not ordinarily cling or hold together as do cottons with more regular, or stronger fibers, the "break" of any cotton should not be relied upon to determine the fiber length. To make an accurate determination of the fiber length the classer must complete the process of making a typical "pull" as outlined in item 75.

77. **Special conditions in stapling.**—Special precautions should be taken in classing cotton of poor character. If cotton is entirely sound and regular in staple, no reduction is made in the staple length. If it is irregular, weak, or wasty, then the length from which and the length to which the reduction is made, as well as the condition on account of which the reduction is made, should be stated.

78. **Perished staple.**—Cotton that has had strength of fiber, as ordinarily found in cotton, destroyed or unduly reduced through exposure to the weather, either before picking or after baling, or through heating by fire, or on account of water packing, or by other causes, is called perished staple. This definition includes not only weakening and deterioration of staple because of exposure of the cotton in the seed, but also because of country damage, ship damage, and fire damage. If such a condition exists, it is noted when the classification is made and no specific length is assigned.

J. INACCURACIES IN STAPLING COTTON

79. **Lack of familiarity with standards an outstanding cause of error.**—Errors or variations in stapling cotton may be due to lack of knowledge of the official staple types. Erratic stapling, as well as the tendency to class too hard or too easy may result from unfamiliarity with the staple types. It is particularly important that before each day's work begins the classer pull the types representing the range of lengths he expects to class during that day. Thus he should be able each morning to adjust accurately his concepts of lengths to the types and thereby avoid departures from them. When a sample is stapled that is out of the prevailing range being classed, one or more of the official staple types should be pulled for comparison with the sample.

80. **Tendency to omit certain lengths.**—One general tendency is that of classifying cottons in sixteenths of an inch, largely ignoring the odd thirty-seconds. Such a tendency can be avoided by frequent reference to the official staple types and by analysis of classification results.

81. **Tendency to class all staples toward familiar lengths.**—Another cause of trouble in classification is the tendency to class all staples toward the lengths with which the classer is most familiar. It is because these inaccuracies arise so subtly that attention must be called to them. If a classer is unaware of this tendency he will fail to realize the need for keeping his judgment up to standard on other staples by constant practice in judging against the standards.

82. **Judging on the "break."**—As already indicated, some classers become accustomed to judging staple length in part by the "break" of the cotton (particularly for the shorter lengths), that is, on the feel of the cotton as the fibers are pulled apart or separated from each other in a "break" of a sample. Staple length determination of a sample should never be decided on the "break."

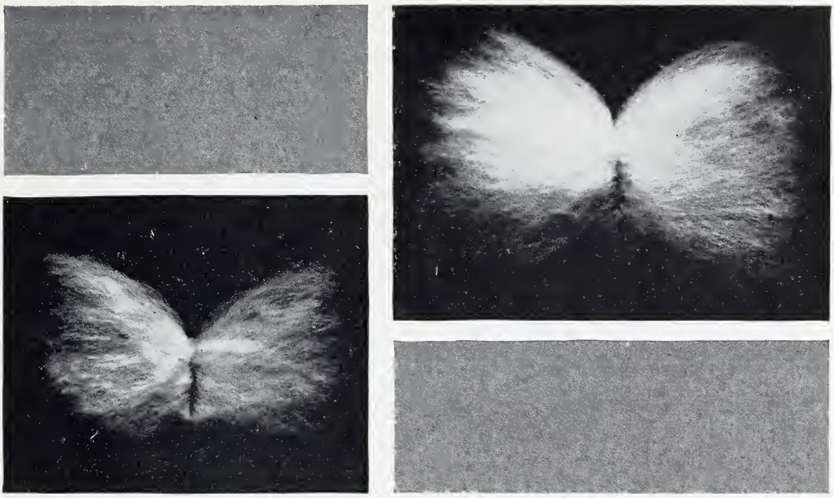
83. **Other causes of error.**—Among the other causes of errors in stapling are: (1) failure to condition samples properly; (2) classing in a poor light under which it is difficult to make correct appraisals; (3) rapid stapling, in which due consideration is not given to irregularities and defects; and (4) failure to pull carefully both sides of the sample. Two samples drawn from the same bale may not be identical in all of the quality elements.

Variability of cotton within a single bale actually is much greater than is usually thought. Fibers vary on the seed. Fibers from bolls produced on different parts of a single cotton plant develop at different times under different conditions. Under present ginning methods a bale often contains some cotton which should have been in the bale ginned previous to it. The length of staple may vary throughout the bale; consequently, two classers or an individual classer in classing different samples from the same bale may assign two different staple lengths and both may be correct in terms of the standards based on the cotton examined.

K. FACTORS OF CHARACTER

84. **General definition of character.**—Character may be defined as those elements of cotton quality which are not included in grade or staple length. There are no character standards.

85. **Purpose of character appraisal.**—The reason for considering character in classification is to provide additional information about the spinning utility of different cottons. Cottons of the same grade and staple may produce satisfactory yarn in some cases and unsatisfactory yarn in others. The reason for the difference in some cases is ascribed to character. Through experience, spinners become familiar with certain character cotton that will or will not give good spinning results for their particular purposes. Good character cottons are usually spoken of as "hardbodied," "fine fiber," or "strong" cottons, and poor character cottons are usually referred to as "soft," "weak," "irregular," "weak and wasty," or "perished." A classer's conception of cotton that meets these designations is influenced by his previous experience in selecting cotton for a particular use. However, in spite of the efforts of a classer or mill superintendent to differentiate between cotton of desirable and undesirable character, classing for character, when put to the practical test of manufacturing results, is often disappointing.



BN—2413

Figure 18.—Uniformity of length. These illustrations show two cottonseeds the lint of which has been combed out to demonstrate uniformity. The specimen at the right is from a pure strain selected for its regularity. Observe the contrast in the specimen on the left which has degenerated into a "butterfly" type.

86. **Factors of character.**—A number of cotton fiber properties are recognized as a part of character—fineness, maturity, tensile strength, length uniformity, spirality, pliability, and cohesiveness of the fibers. Some of these properties are measurable (see item M) but others are not.

87. **Uniformity of length.**—Uniformity of fiber length, a measurable factor, is important because it is closely related to spinning utility. The classer recognizes irregular cotton when, in pulling the staple, he has difficulty in obtaining a definite, smooth, rectangular tuft of cotton, and when, in pulling out the long fibers and discarding them, he never comes to any very definite length. A uniform cotton, on the other hand, may be readily pulled to its staple length.

Uniformity of fiber length is important because it affects the qantity of waste in manufacturing as well as the strength and appearance of yarn. Cotton of relatively uniform fiber length can be processed into stronger and better appearing yarn with a lower percentage of manufacturing waste than cotton that is irregular in fiber length. Figure 18 illustrates types of seed cotton that will produce irregular lint as compared with seed cotton that will produce uniform lint.

88. **Strength of fiber.**—Strength of fiber, another measurable character factor, is also important. Although fiber strength depends largely on variety and growth, it may be affected by weather exposure, excess moisture, deterioration from bacteriological and other organic action, and by ginning practices that injure the fibers. Studies indicate that strength of fiber is related to length in varying degrees. A classer can get an impression of strength by pulling out some of the fibers and breaking them in his fingers. Accurate measurements of strength, however, must be made in the laboratory.

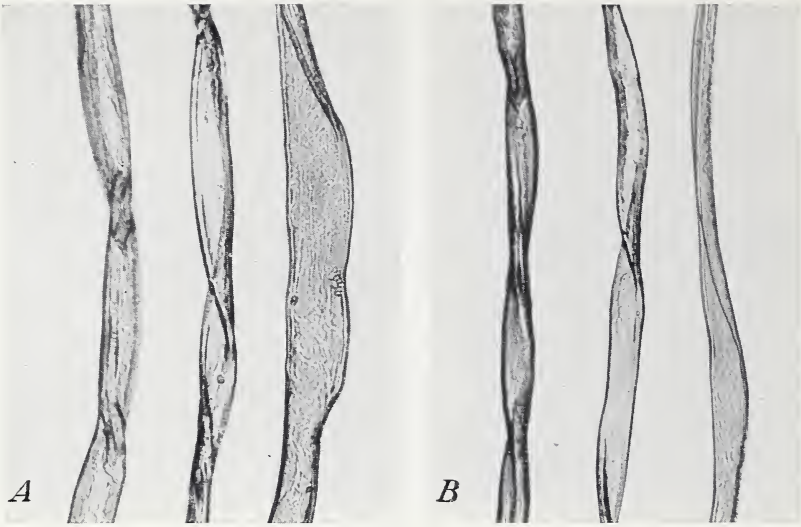


Figure 19.—Range of wall thickness in coarse (A) and fine (B) fibers. (Magnified)

89. **Fineness and maturity of fibers.**—Two other elements of character for which laboratory tests are available are fiber fineness and fiber maturity. Laboratory tests for fineness may consist of the measurement of either weight fineness or geometrical fineness, the former being in terms of weight per unit length of the fiber and the latter in terms of some linear dimension of the cross section of the fiber. The measure of maturity helps to explain the fineness or coarseness by giving information about the thickness of the fiber wall (fig. 19). Figure 20 gives an idea of the wide range in geometrical fineness and in wall thickness of fibers of selected cottons.

L. EFFECT OF MOISTURE ON STAPLE AND CHARACTER

90. **Physical properties affected by moisture content.**—Various properties of cotton are affected by moisture. (The term "moisture content" is sometimes used in referring to the amount of water in cotton. It differs from "regain" only in the base on which it is figured. Regain is figured on a bone-dry-weight—whereas moisture content is figured on the original weight, which includes the moisture). These properties—pliability, drag, strength, and length—affect each other, and together they undoubtedly influence the classer in the process of stapling. Several of these are character factors, but as moisture also affects the stapling process through its effect upon these several factors, they are discussed here in a separate section.

91. **Frictional Properties.**—If a handful of ginned lint is examined closely, it will be observed that the fibers are entangled, a fact which is evident each time a classer breaks a sample in the process of stapling. The individual fibers are wavy, and the waviness is a partial cause of the resistance which the classer notices in breaking a sample. Furthermore, this resistance is influenced by the limberness of the fibers, or

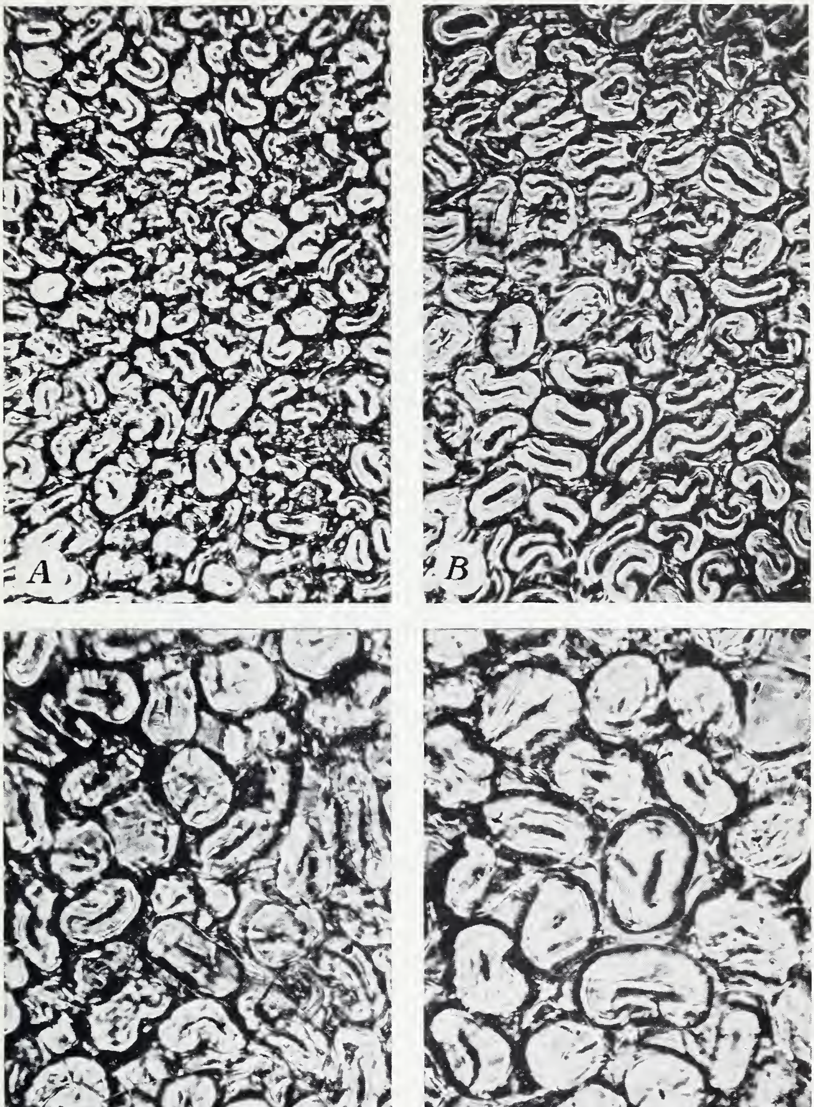


Figure 20.—Range of geometrical fineness and cross-sectional shape of cotton fibers from selected samples: A, fine; B, average; C, coarse; D, very coarse. (Magnified)

the ease with which the individual waves straighten out and allow the fibers to slide past each other. Thus, there is a chain of events depending on the relative humidity of the atmosphere, which causes differences in breaking resistance or drag. Drag depends upon the number and regularity of fiber convolutions as well as the waviness of the fibers and their tangled condition. The convolutions, in contrast to waviness, are small twists of the fiber that are invisible to the naked eye. The number of these convolutions per inch decreases as the moisture content of the fiber increases.

92. **Strength.**—The strength of fiber, which is also influenced by moisture content, increases considerably as the humidity of the atmosphere in contact with the fibers is increased.

93. **Controlled Humidity Needed.**—The amount of moisture affects the strength and frictional properties of the fibers so that the classer may arrive at different decisions of length for the same sample under different conditions. Stapling under controlled humidity and temperature gives much more consistent results and should be used wherever possible. Classification of wet or extremely dry cotton should be avoided at all times.

M. LABORATORY METHODS FOR DETERMINING FIBER PROPERTIES

94. **The use of laboratory instruments or machines.**—Laboratory machines or instruments serve to supplement the classer's art or skill. The laboratory is able to determine color, foreign matter content, fiber strength, fineness, maturity, length, and length uniformity by means of scientific instruments or machines used today in many textile testing laboratories. Certain of these and other tests are described [8] with figures provided regarding the accuracy or reproducibility of test results. Included in the test series is Test No. 8 which consists of 1-pound samples of short, medium, and long cottons together with test data obtained in the USDA laboratories. Those who operate their own laboratories may correlate their results with those obtained in the laboratories of the Cotton Division of the Agricultural Marketing Service. To promote uniformity of making and reporting test results many of the test methods are standardized and published by the American Society for Testing Materials.[9]

95. **Cotton Colorimeter.**—As noted in item 11, a visual type of disk colorimeter has been used for many years in measuring the color of cotton in preparing the cotton grade standards. In 1950 the Nickerson-Hunter Cotton Colorimeter (fig. 21) was developed to replace the visual method. It is a fully automatic, self-standardizing, photoelectric instrument provided with a color diagram of the upland cotton grade standards.[10] The color scales on the instrument are in terms of percent reflectance (Rd) and degree of yellowness (Hunter's +b factor). For cotton color, in which the hue is fairly constant, these two scales provide a satisfactory picture of the visual

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[8] See footnote 2, p. 9.

[9] American Society For Testing Materials. Tentative General Methods of Testing Cotton Fibers. ASTM—D414–52T. ASTM Standards on Textile Materials. Published by American Society for Testing Materials, Philadelphia 3, Pa. 1952.

[10] See footnote 1, p. 5.

lightness and chroma differences in the various upland cottons. To operate the instrument one simply places a representative sample of cotton over a window (3¾x4 inches) and presses a button to open a shutter so that the sample is visible to the photocell-filter combination of the colorimeter head, then automatic indicators move to a position of balance that indicate the degree of lightness (on a vertical scale) and the degree of yellowness (on a horizontal scale) of the measured sample. Because these color factors are indicated against a diagram of the color of the grade standards, the color of a cotton sample may be read directly in terms of the average color of whatever one of the grade standards it most nearly matches. Differences in kind and amount of leaf or foreign material, and differences in preparation, will show up to some degree on the colorimeter. The instrument may be used to measure a cotton sample as it comes from the bale, or at any stage of processing in the mill in which a representative sample 3¾ by 4 inches can be obtained to place on the instrument window.

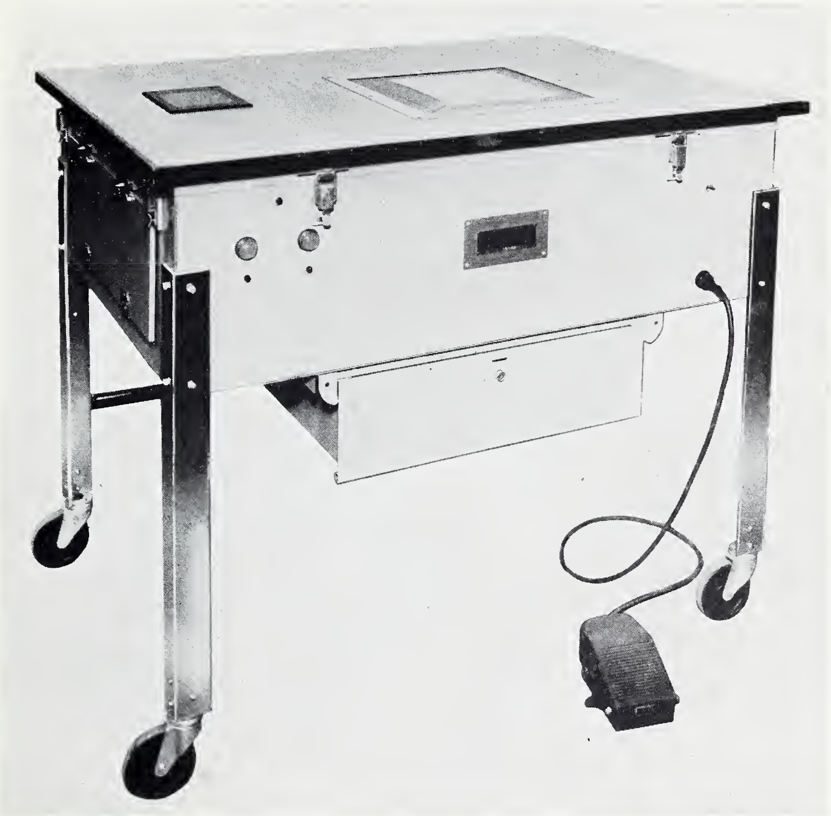

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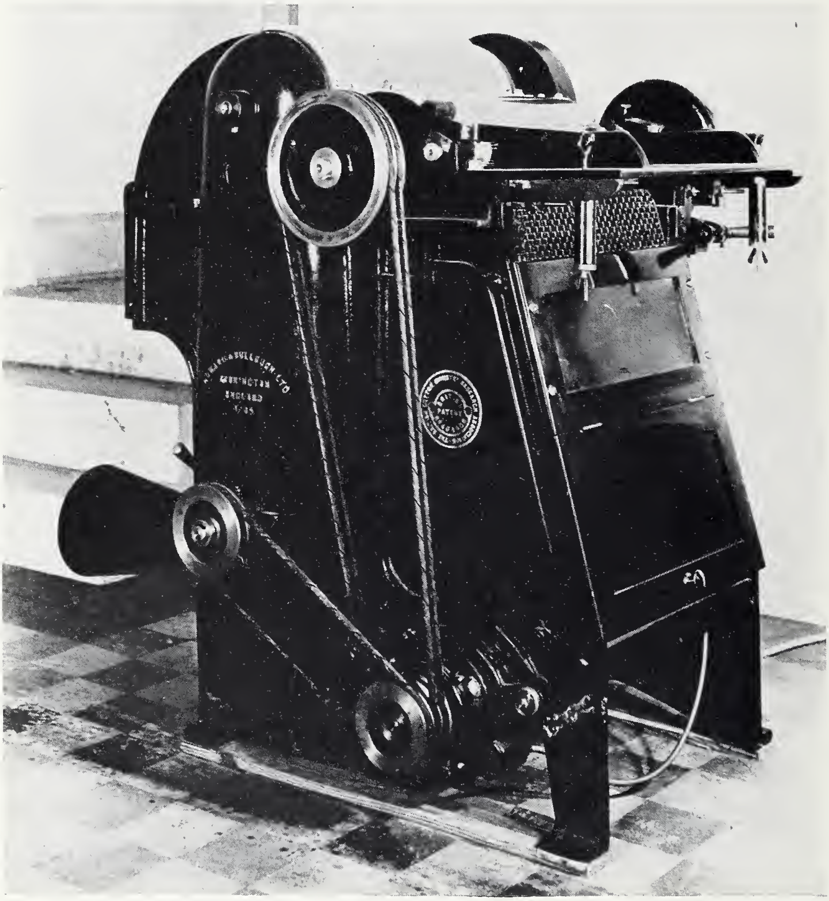
Figure 21.—Nickerson-Hunter Cotton Colorimeter

Although the usual type of colorimeter is designed for laboratory use, this instrument was designed specifically for cotton, and for use in the classing room. It finds its most rewarding application in the hands of a good classer who can interpret the color information in relation to the several other factors that he must take into consideration in establishing the grade of any sample. A set of tile and porcelain color standards are provided among the Cotton Testing Service items listed in [11]. This enables users of these colorimeters to keep them on the same calibration level that is used in the United States Department of Agriculture laboratories in holding constant the color of the cotton grade standards.



BN–2416

Figure 22.—Shirley Analyzer for separating foreign material from fibers.

96. **Shirley Analyzer.**—The Shirley Analyzer is used for separating foreign material from fibers in samples of raw cotton or manufacturing waste. This machine, see figure 22, makes an almost perfect separation of lint and trash in a cotton sample. Nonlint percentages based on measurements of the weight of trash in bales used in the grade standards are given in table 2 of this publication. In the purchase of cotton for the grade standards, Shirley Analyzer

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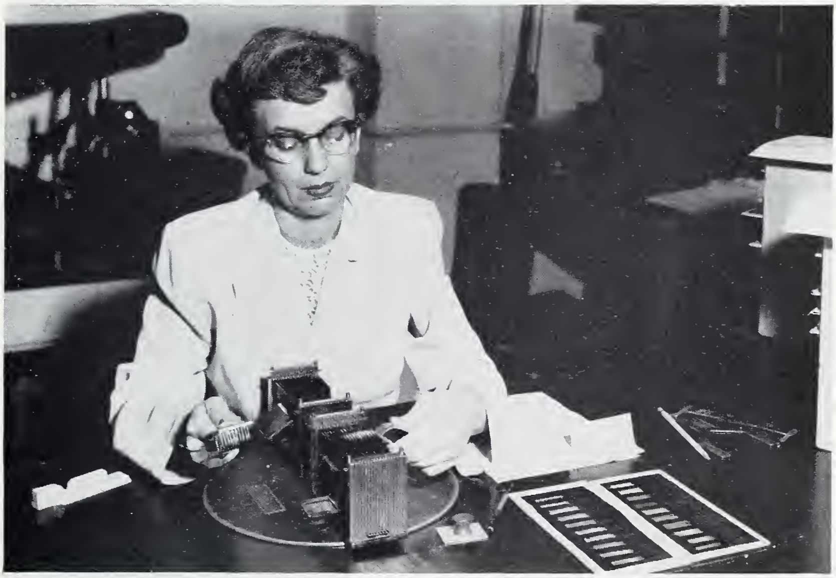
[11] See footnote 2, p. 9.

tests are used as a basis for helping to keep the trash content in the several grades within tolerances to help prevent any overlap between grades. Nonlint removed by the Shirley Analyzer differs from the total picker and card waste measured in the manufacturing process because it contains practically no fiber. Although many things have yet to be learned in the laboratory about measuring amounts and kinds of trash, the Shirley Analyzer is the first machine to provide a reliable method for measuring trash by weight.

97. **Suter-Webb fiber sorter.**—This instrument (fig. 23) is more widely used in research studies of cotton than it is for general testing of samples. By means of a bank of combs, representative samples of cotton may be sorted and arrayed on velvet-covered boards according to length; length groups are measured and weighed; and averages for upper quartile length, mean length, coefficient of length variation, and percentages of fibers in each group may be calculated and reported for the sample.



BN-2417

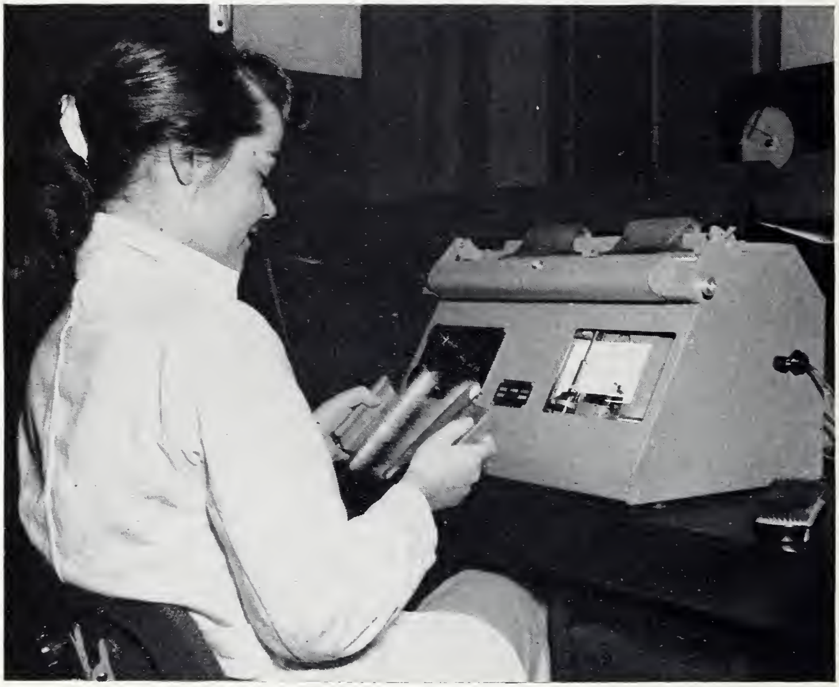
FIGURE 23.—Technician performing fiber length tests on cotton lint using the Suter-Webb fiber sorter.

98. **Fibrograph.**—The Fibrograph (fig. 24) is a photoelectric device which provides a measure of the length and length uniformity of the fibers in a sample of cotton. It provides measurements of the upper half mean length, the mean length, and a uniformity ratio which provides a relative measure of the length uniformity of the fibers. This instrument is the one most widely used in fiber laboratories for general testing of length.

99. **Pressley Strength Tester.**—The Pressley Strength Tester is the standard instrument for measuring the strength of cotton fiber. In making the test, cotton is hand-combed and the fibers are parallelized

in the form of a flat ribbon about one-fourth-inch wide and then placed in a set of breaking clamps. The fibers are cut to a definite length, broken in the Pressley Tester, and then weighed. The strength of the specimen, as indicated on the beam of the machine, is read to the nearest tenth of a pound and the weight of the specimen is read to the nearest hundredth of a milligram. The breaking strength in thousand pounds per square inch is obtained from special tables on the basis of beam reading and specimen weight. Fiber strength is an important factor in determining yarn strength. (See fig. 25.)

100. **Micronaire.**—The Micronaire (fig. 26) is now a standard instrument for measuring fineness of cotton fibers. Testing by this method is much more rapid than by other available methods. The Micronaire was designed to evaluate fineness of cotton fibers by measuring the resistance to the passage of air through a sample of cotton of fixed weight compressed to a given volume. The finer the fibers the greater is the resistance to airflow and the coarser the fibers, the greater is the airflow. A direct reading scale for this instrument to indicate fiber fineness in terms of micrograms per inch of fiber has been developed. Separate scales are used on upland cotton and American Egyptian or other extra long staple cottons. Micronaire test results, however, reflect fineness and maturity in combination rather than inherent fineness of the fibers. In order to measure these properties separately, a special technique known as the Causticaire Method for Measuring Fiber Fineness and Maturity has been devel-



N–13729

Figure 24.—Technician performing fiber length tests on cotton lint using the Fibrograph instrument.

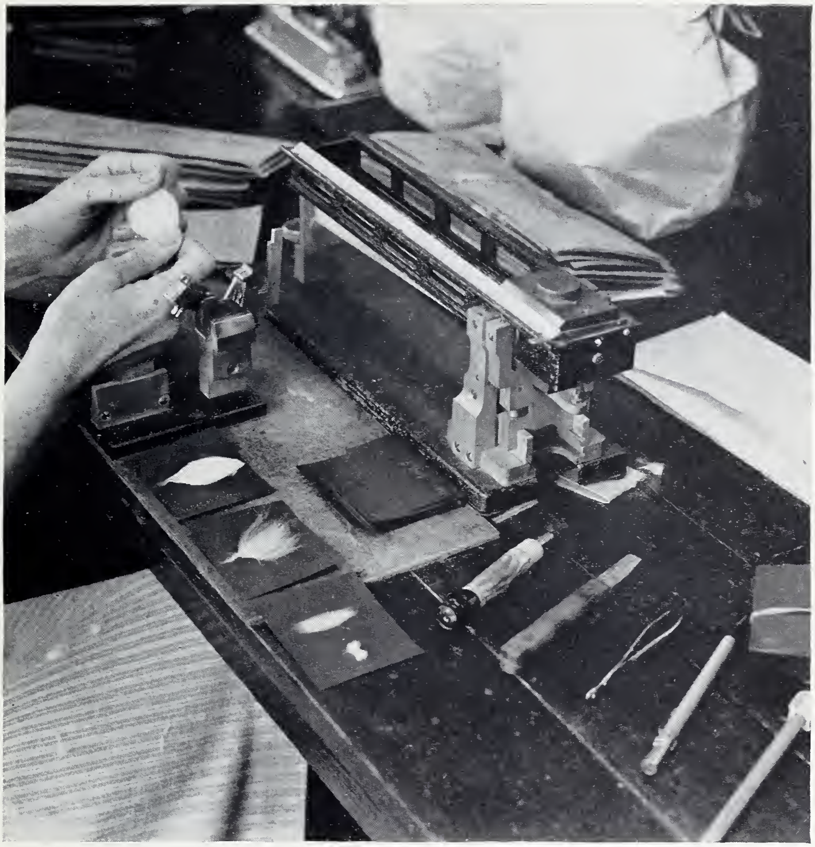

BN–2401

Figure 25.—Pressley Strength Tester.

oped. In making tests by this method, the Micronaire instrument is used with a special Causticaire scale for making readings on test specimens of both untreated cotton and cotton treated with sodium hydroxide (40 TW). The caustic treatment swells the fibers causing them to become cylindrical in shape. Thus, fineness values for all botanical types of cotton can be read from a single Micronaire scale. The maturity or degree of cell-wall development of the fibers can be calculated from the Micronaire readings on the treated and untreated samples.

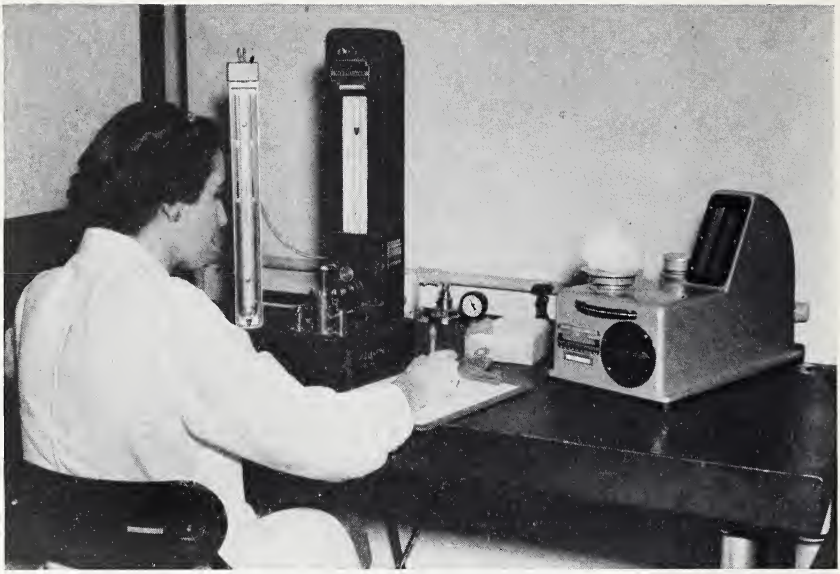

N-13728

Figure 26.—Technician performing fiber fineness and maturity tests in combination using the Micronaire instrument.

APPENDIX

OFFICIAL COTTON STANDARDS OF THE UNITED STATES

[Those indicated by an asterisk (*) are descriptive standards]

FOR GRADES AND COLORS OF AMERICAN UPLAND COTTON

Good Middling
Strict Middling
Middling
Strict Low Middling
Low Middling
Strict Good Ordinary
Good Ordinary
*Good Middling Spotted
*Strict Middling Spotted
*Middling Spotted
*Strict Low Middling Spotted
*Low Middling Spotted
*Good Middling Tinged
Strict Middling Tinged
Middling Tinged
Strict Low Middling Tinged
Low Middling Tinged
*Good Middling Yellow Stained
*Strict Middling Yellow Stained
*Middling Yellow Stained
*Good Middling Gray
*Strict Middling Gray
*Middling Gray
*Strict Low Middling Gray

LENGTH OF STAPLE

Inches

[12] *Below $\frac{3}{4}$
[12] $\frac{3}{4}$
$\frac{13}{16}$
$\frac{7}{8}$
$\frac{29}{32}$
$\frac{15}{16}$
$\frac{31}{32}$
1
$1\frac{1}{32}$
$1\frac{1}{16}$
$1\frac{3}{32}$
$1\frac{1}{8}$
$1\frac{5}{32}$
$1\frac{3}{16}$
$1\frac{7}{32}$
$1\frac{1}{4}$
[12] $1\frac{9}{32}$
$1\frac{5}{16}$
[12] $1\frac{11}{32}$
$1\frac{3}{8}$ (types for both American upland and American Egyptian)

Inches

*$1\frac{13}{32}$
$1\frac{7}{16}$ (types for American Egyptian only)
*$1\frac{15}{32}$
[12] $1\frac{1}{2}$ (types for American upland, American Egyptian, and Sea-Island)
*$1\frac{17}{32}$
$1\frac{9}{16}$ (types for American Egyptian and Sea-Island only)
*$1\frac{19}{32}$
$1\frac{5}{8}$ (types for American Egyptian and Sea-Island only)
*$1\frac{21}{32}$
*$1\frac{11}{16}$
*$1\frac{23}{32}$
$1\frac{3}{4}$ (types for American Egyptian and Sea-Island only) and upward in steps of $\frac{1}{32}$ inch (No types above $1\frac{3}{4}$ inches)

STANDARDS FOR GRADES OF AMERICAN EGYPTIAN COTTON

Grade No. 1
Grade No. 2
Grade No. 3
Grade No. 4
Grade No. 5
Grade No. 6
Grade No. 7
Grade No. 8
Grade No. 9
*Grade No. 10

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[12] On June 1, 1957, the following changes in official staple standards are effective: (1) the lengths "Below $\frac{3}{4}$" and "$\frac{3}{4}$" deleted; the length "Below $\frac{13}{16}$" (descriptive) added; and the lengths "$1\frac{9}{32}$," "$1\frac{11}{32}$," and "$1\frac{1}{2}$" for upland cotton changed from physical form to descriptive standards.

STANDARDS FOR GRADES OF SEA-ISLAND COTTON

Grade No. 1
*Grade No. 1½
Grade No. 2
*Grade No. 2½
Grade No. 3
*Grade No. 3½
Grade No. 4
*Grade No. 4½
Grade No. 5
*Grade No. 5½
Grade No. 6
*Below Grade No. 6

TENTATIVE STANDARDS FOR PREPARATION OF LONG-STAPLE COTTON

A preparation, Strict Middling
B preparation, Strict Middling
C preparation, Strict Middling
A preparation, Middling
B preparation, Middling
C preparation, Middling
A preparation, Strict Low Middling
B preparation, Strict Low Middling
C preparation, Strict Low Middling

UNITED STATES COTTON LINTERS

Official standards for United States Cotton Linters have also been established under the Cotton Standards Act. Information regarding these standards may be obtained from the Cotton Division of the Agricultural Marketing Service at Washington 25, D. C.

PUBLIC NOTICE ESTABLISHING OFFICIAL COTTON STANDARDS OF THE UNITED STATES FOR THE GRADE OF AMERICAN UPLAND COTTON, EFFECTIVE AUGUST 15, 1953

On June 7, 1952, a notice of proposed rule making was published in the Federal Register (17 F. R. 5195) regarding the proposed revision of the Official Cotton Standards of the United States for the Grade of American Upland Cotton (7 CFR 27.151 through 27.186). Pursuant to the notice, a public meeting was held in Washington on June 19, 1952, to allow interested persons to inspect the proposed revised standards and to submit data, views, or arguments concerning the proposed revision. The proposed revised standards were presented for approval to representatives of the signatories to the Universal Cotton Standards Agreements at a meeting held in Le Havre, France, on July 17, 1952.

After investigation and due consideration of all relevant matters presented as a result of the aforesaid notice and meetings, the following Official Cotton Standards of the United States for the Grade of American Upland Cotton are hereby promulgated, to supersede the provisions in Title 7, Code of Federal Regulations, Sections 27.151 through 27.186, pursuant to the authority contained in the United States Cotton Futures Act (39 Stat. 476, as amended, codified at 53 Stat. 210; 26 U. S. C. 1920 et seq.) and in the United States Cotton Standards Act (42 Stat. 1518, as amended; 7 U. S. C. 51 et seq.):

AUTHORITY: Sections 27.151 to 27.176 issued under sec. 6, 42 Stat. 1518, sec. 1926, 53 Stat. 213; 7 U. S. C. 56, 26 U. S. C. 1926.

WHITE COTTON

SEC. 27.151 *Good Middling.*—Good Middling shall be American upland cotton which in color, leaf, and preparation is better than Strict Middling.

[NOTE.—On July 21, 1953, Good Middling was promulgated as a physical standard and Section 27.151 was amended to read as follows, effective August 1, 1954:

SEC. 27.151 *Good Middling.*—Good Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Good Middling, effective August 1, 1954."]

SEC. 27.152 *Strict Middling.*—Strict Middling shall be American upland cotton which in color, leaf and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Strict Middling, effective August 15, 1953."

SEC. 27.153 *Middling.*—Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Middling, effective August 15, 1953."

SEC. 27.154 *Strict Low Middling.*—Strict Low Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Strict Low Middling, effective August 15, 1953."

SEC. 27.155 *Low Middling.*—Low Middling shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Low Middling, effective August 15, 1953."

SEC. 27.156 *Strict Good Ordinary.*—Strict Good Ordinary shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Strict Good Ordinary, effective August 15, 1953."

SEC. 27.157 *Good Ordinary.*—Good Ordinary shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Good Ordinary, effective August 15, 1953."

SPOTTED COTTON

SEC. 27.158 *Good Middling Spotted.*—Good Middling Spotted shall be American upland cotton which in leaf and preparation is Good Middling, but which in spot or color or both is between Good Middling and Good Middling Tinged.

SEC. 27.159 *Strict Middling Spotted.*—Strict Middling Spotted shall be American upland cotton which in leaf and preparation is Strict Middling, but which in spot or color or both is between Strict Middling and Strict Middling Tinged.

SEC. 28.160 *Middling Spotted.*—Middling Spotted shall be American upland cotton which in leaf and preparation is Middling, but which in spot or color or both is between Middling and Middling Tinged.

SEC. 27.161 *Strict Low Middling Spotted.*—Strict Low Middling Spotted shall be American upland cotton which in leaf and preparation is Strict Low Middling, but which in spot or color or both is between Strict Low Middling and Strict Low Middling Tinged.

SEC. 27.162 *Low Middling Spotted.*—Low Middling Spotted shall be American upland cotton which in leaf and preparation is Low Middling, but which in spot or color or both is between Low Middling and Low Middling Tinged.

TINGED COTTON

SEC. 27.163 *Good Middling Tinged.*—Good Middling Tinged shall be American upland cotton which in color, leaf, and preparation is better than Strict Middling Tinged.

SEC. 27.164 *Strict Middling Tinged.*—Strict Middling Tinged shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Strict Middling Tinged, effective August 15, 1953."

SEC. 27.165 *Middling Tinged.*—Middling Tinged shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Middling Tinged, effective August 15, 1953."

SEC. 27.166 *Strict Low Middling Tinged.*—Strict Low Middling Tinged shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Strict Low Middling Tinged, effective August 15, 1953."

Sec. 27.167 *Low Middling Tinged.*—Low Middling Tinged shall be American upland cotton which in color, leaf, and preparation is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Upland, Low Middling Tinged, effective August 15, 1953."

YELLOW STAINED COTTON

Sec. 27.168 *Good Middling Yellow Stained.*—Good Middling Yellow Stained shall be American upland cotton which in leaf and preparation is Good Middling Tinged, but which in color is deeper than Good Middling Tinged.

Sec. 27.169 *Strict Middling Yellow Stained.*—Strict Middling Yellow Stained shall be American upland cotton which in leaf and preparation is Strict Middling Tinged, but which in color is deeper than Strict Middling Tinged.

Sec. 27.170 *Middling Yellow Stained*—Middling Yellow Stained shall be American upland cotton which in leaf and preparation is Middling Tinged, but which in color is deeper than Middling Tinged.

GRAY COTTON

Sec. 27.171 *Good Middling Gray.*—Good Middling Gray shall be American upland cotton which in leaf and preparation is Good Middling, but which is more gray in color than Good Middling and no darker in color than the dullest bale in Strict Low Middling.

Sec. 27.172 *Strict Middling Gray.*—Strict Middling Gray shall be American upland cotton which in leaf and preparation is Strict Middling, but which is more gray in color than Strict Middling and no darker in color than the dullest bale in Low Middling.

Sec. 27.173 *Middling Gray.*—Middling Gray shall be American upland cotton which in leaf and preparation is Middling, but which is more gray in color than Middling and no darker in color than the dullest bale in Strict Good Ordinary.

Sec. 27.174 *Strict Low Middling Gray.*—Strict Low Middling Gray shall be American upland cotton which in leaf and preparation is Strict Low Middling, but which is more gray in color than Strict Low Middling and no darker in color than the dullest bale in Good Ordinary.

GENERAL

Sec. 27.175 *General.*—American upland cotton which in color, leaf, and preparation is within the range of the standards established by this subpart, but which contains a combination of color, leaf, and preparation not within any one of the standards set out in this subpart, shall be designated according to the standard which is equivalent to, or if there be no exact equivalent is next below, the average of all the factors that determine the grade of the cotton: *Provided*, That in no event shall the grade assigned to any cotton or sample be more than one grade higher than the grade classification of the color or leaf contained therein.

Sec. 27.176 *Alternate title for standards.*—Since these standards have been agreed upon and accepted by the leading European cotton associations and exchanges, they may also be termed and referred to as the "Universal Standards for American Cotton."

Effective date.—The provisions in Sections 27.151 through 27.176 shall become effective at 12: 01 a. m., e. s. t., August 15, 1953.

The provisions in Sections 27.151 through 27.176 on their effective date shall supersede the present provisions in Sections 27.151 through 27.186.

Done at Washington, D. C., this 12th day of August 1952.

[SEAL]

Charles F. Brannan,
Secretary of Agriculture.

PUBLIC NOTICE ESTABLISHING OFFICIAL STANDARDS FOR LENGTH OF STAPLE

Department of Agriculture,
Washington.

Pursuant to the authority vested in the Secretary of Agriculture by section 9 of the United States Cotton Futures Act approved August 11, 1916, 39 United

States Statutes at Large, page 476, I, David F. Houston, Secretary of Agriculture, do hereby establish, promulgate, and give public notice of, standards for length of staple of cotton, effective October 25, 1918, as follows:

OFFICIAL COTTON STANDARDS OF THE UNITED STATES FOR LENGTH OF STAPLE

For the purposes of these standards:

SECTION 1.—The length of staple of any cotton shall be the normal length by measurement, without regard to quality or value, of a typical portion of its fibers under a relative humidity of the atmosphere of 65 percent and a temperature of 70° F.

SEC. 2.—The length of staple of any cotton shall be designated by that one of the following terms which expresses its measurement in inches or fractions of an inch in accordance with section 1 of this order:

Below $\frac{3}{4}$; $\frac{3}{4}$; $\frac{13}{16}$; $\frac{7}{8}$; $\frac{15}{16}$; 1; $1\frac{1}{32}$; $1\frac{1}{16}$; $1\frac{3}{32}$; $1\frac{1}{8}$; $1\frac{5}{32}$; $1\frac{3}{16}$; $1\frac{7}{32}$; $1\frac{1}{4}$; $1\frac{9}{32}$; $1\frac{5}{16}$; $1\frac{11}{32}$; $1\frac{3}{8}$; $1\frac{13}{32}$; $1\frac{7}{16}$; $1\frac{15}{32}$; $1\frac{1}{2}$; $1\frac{17}{32}$; $1\frac{9}{16}$; $1\frac{19}{32}$; $1\frac{5}{8}$; $1\frac{21}{32}$; $1\frac{11}{16}$; $1\frac{23}{32}$; $1\frac{3}{4}$; and upward in like manner in gradations of thirty-seconds, disregarding any fraction less than a thirty-second.

SEC. 3.—The lengths of staple designated as $\frac{3}{4}$, $\frac{7}{8}$, 1, $1\frac{1}{8}$, $1\frac{1}{4}$, $1\frac{3}{8}$, $1\frac{1}{2}$, $1\frac{5}{8}$, and $1\frac{3}{4}$ inches, respectively, are each represented by a sample in the custody of the United States Department of Agriculture in a container marked "Original Official Cotton Standards of the United States, Length of Staple" followed by the appropriate designations of such length of staple.

SEC. 4.—Cotton which is more than three-fourths of an inch in length of staple, but is not exactly one of the measurements specified in section 2 of this order, shall be designated by that one of such measurements which comes nearest under its true measurement.

SEC. 5.—Whenever the length of staple of cotton taken from one part of a bale is different from that taken from another part of the same bale, the length of staple of the cotton in such bale shall be that of the part which is the shorter.

In testimony whereof, I have hereunto set my hand and caused the official seal of the Department of Agriculture to be affixed, in the District of Columbia, this 25th day of October 1918.

[SEAL] D. F. HOUSTON, *Secretary.*

NOTE.—Sections 2 and 3 of the foregoing order have been revised from time to time. As now in effect, these two sections read as follows:

SEC. 2.—The length of staple of any cotton shall be designated by that one of the following terms which expresses its measurement in inches or fractions of an inch in accordance with section 1 of this order:

Below $\frac{3}{4}$; $\frac{3}{4}$; $\frac{13}{16}$; $\frac{7}{8}$; $\frac{29}{32}$; $\frac{15}{16}$; $\frac{31}{32}$; 1; $\frac{11}{32}$; $1\frac{1}{16}$; $1\frac{3}{32}$; $1\frac{1}{8}$; $1\frac{5}{32}$; $1\frac{3}{16}$; $1\frac{7}{32}$; $1\frac{1}{4}$; $1\frac{9}{32}$; $1\frac{5}{16}$; $1\frac{11}{32}$; $1\frac{3}{8}$; $1\frac{13}{32}$; $1\frac{7}{16}$; $1\frac{15}{32}$; $1\frac{1}{2}$; $1\frac{17}{32}$; $1\frac{9}{16}$; $1\frac{19}{32}$; $1\frac{5}{8}$; $1\frac{21}{32}$; $1\frac{11}{16}$; $1\frac{23}{32}$; $1\frac{3}{4}$; and upward in like manner in gradations of thirty-seconds, disregarding any fraction less than thirty-second.

Sec. 3.—The lengths of staple designated as $\frac{3}{4}$, $\frac{13}{16}$, $\frac{7}{8}$, $\frac{29}{32}$, $\frac{15}{16}$, $\frac{31}{32}$, 1, $1\frac{1}{32}$, $1\frac{1}{16}$, $1\frac{3}{32}$, $1\frac{1}{8}$, $1\frac{5}{32}$, $1\frac{3}{16}$, $1\frac{7}{32}$, $1\frac{1}{4}$, $1\frac{9}{32}$, $1\frac{5}{16}$, $1\frac{11}{32}$, $1\frac{3}{8}$, $1\frac{1}{2}$ inches, respectively, are each represented by a quantity of American upland cotton suitably contained and marked "Original representation of official cotton standards of the United States (American upland), length of staple," followed in each instance by the appropriate designation of staple length and the effective date hereof; and the lengths of staple designated as $1\frac{3}{8}$, $1\frac{7}{16}$, $1\frac{1}{2}$, $1\frac{9}{16}$, $1\frac{5}{8}$, and $1\frac{3}{4}$ inches are each represented by a quantity of American-Egyptian cotton suitably contained, and marked "Original representation of official cotton standards of the United States (American-Egyptian), length of staple," followed in each instance by the appropriate designation of staple length and the effective date hereof; and the length of staple designated as $1\frac{1}{2}$, $1\frac{9}{16}$, $1\frac{5}{8}$, and $1\frac{3}{4}$ inches are each represented by a quantity of Sea Island cotton suitably contained, and marked "Original representation of official cotton standards of the United States (Sea Island), length of staple," followed in each instance by the appropriate designation of staple length and the effective date hereof; which said quantities of cotton are to be kept in the custody of the United States Department of Agriculture.

CHANGES IN SECTIONS 2 AND 3 EFFECTIVE JUNE 1, 1957

Effective June 1, 1957, Section 2 is amended by deleting the lengths "Below $\frac{3}{4}$" and "$\frac{3}{4}$" and adding the length "Below $\frac{13}{16}$"; Section 3 is amended by deleting the lengths "$\frac{3}{4}$," "$1\frac{9}{32}$," "$1\frac{11}{32}$," and "$1\frac{1}{2}$" for upland cotton.

PUBLIC NOTICE ESTABLISHING OFFICIAL GRADE STANDARDS FOR AMERICAN EGYPTIAN COTTON

The grade standards now in effect for American Egyptian cotton were promulgated by the Secretary of Agriculture on July 27, 1951, effective August 1, 1952:

Official Cotton Standards of the United States for the Grade of American Egyptian Cotton

On June 22, 1951, a notice of proposed rule making was published in the Federal Register (16 F. R. 5953) regarding the proposed revision of official standards for grades of cotton of varieties known as American Egyptian. After consideration of all relevant matters presented and allowing the industry the opportunity to view the revised grade standards, the following official standards of the United States for the grade of American Egyptian cotton are hereby promulgated under the authority contained in section 9 of the United States Cotton Futures Act of August 11, 1916 (39 Stat. 479, 53 Stat. 213; 26 U. S. C. 1926), and section 6 of the United States Cotton Standards Act of March 4, 1923 (42 Stat. 1518; 7 U. S. C. 56). The official cotton standards shall be effective on and after August 1, 1952, and shall, on that date, supersede and replace the present standards for grades of American Egyptian Pima and SXP cotton which were promulgated by the Secretary of Agriculture on March 19, 1940.

AMERICAN EGYPTIAN COTTON

SEC. 27.251 *Grade No. 1.*—Grade No. 1 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 1, effective August 1, 1952."

SEC. 27.252 *Grade No. 2.*—Grade No. 2 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 2, effective August 1, 1952."

SEC. 27.253 *Grade No. 3.*—Grade No. 3 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 3, effective August 1, 1952."

SEC. 27.254 *Grade No. 4.*—Grade No. 4 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 4, effective August 1, 1952."

SEC. 27.255 *Grade No. 5.*—Grade No. 5 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 5, effective August 1, 1952."

SEC. 27.256 *Grade No. 6.*—Grade No. 6 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 6, effective August 1, 1952."

SEC. 27.257 *Grade No. 7.*—Grade No. 7 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 7, effective August 1, 1952."

SEC. 27.258 *Grade No. 8.*—Grade No. 8 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 8, effective August 1, 1952."

SEC. 27.259 *Grade No. 9.*—Grade No. 9 shall be American Egyptian cotton which in grade is within the range represented by a set of samples in the custody of the United States Department of Agriculture in the District of Columbia in a container marked "Original Official Cotton Standards of the United States, American Egyptian, Grade No. 9, effective August 1, 1952.'

SEC. 27.260 *Grade No. 10.*—American Egyptian cotton which in grade is inferior to grade No. 9 shall be designated as "American Egyptian Grade No. 10."

Until their effective date, August 1, 1952, the foregoing standards may be used as permissive standards in the purchase and sale of American Egyptian cotton.

(Sec. 9, 39 Stat. 479, 53 Stat. 213, Sec. 6, 42 Stat. 1518; 26 U. S. C. 1926, 7 U. S. C. 56)

Done at Washington, D. C., this 27th day of July 1951. Witness my hand and the seal of the Department of Agriculture.

[SEAL] C. J. MCCORMICK,
Acting Secretary of Agriculture.

STANDARDS FOR SEA-ISLAND COTTON

Grade standards for Sea-Island cotton were first promulgated on August 25, 1918, but these standards were discontinued by an order signed by the Secretary of Agriculture on January 22, 1925. Owing to ravages of the boll weevil Sea-Island cotton had virtually disappeared from the American crop and there was no longer any demand for copies of the standards and no cotton available with which to make such copies.

In 1938, however, the Sea-Island crop had revived to some extent in the States of Georgia and Florida and various persons interested in cotton of this variety had requested the Department again to establish Sea-Island standards. New grade boxes were promulgated August 10, 1938 to be effective August 10, 1939.

COTTON CLASSIFICATION SERVICES

All cotton classed by the Government is classed for grade and staple length in terms of the official cotton standards of the United States. No deviation from the standards for any purpose is permissible. All upland cotton is classed against the upland standards, all American Egyptian against the American Egyptian standards, and all Sealand and Sea Island cotton against the Sea Island standards, regardless of whether the cotton is ginned on a roller gin or a saw gin.

Services under the Smith-Doxey Act—Classing without Charge for Farmers

Farmers who form organized groups for cotton improvement and who comply with certain requirements are entitled to have their cotton classed without paying a fee. The samples submitted for this classification service must be a sealed sample drawn by means of an automatic sampler or be cut from both sides of the bale by a bonded sampler or a public warehouseman that issues negotiable receipts. A Cotton Classification Memorandum Form 1 (green card) showing the official grade and staple length of each sample is issued by the classing office serving the territory where the cotton is ginned. The samples become the property of the Government after classification.

The class cards or memorandums may be used by the farmers in selling cotton or obtaining Commodity Credit Corporation loans. This information on grade and staple length may also be used in determining the variety of cotton best adapted for each farm, the degree of care that can economically be used in harvesting, and the quality of ginning.

Instructions and applications may be obtained by farmers who wish to organize cotton improvement groups under the Smith-Doxey Act from County Agricultural Agents, or from any office of the Cotton Division, Agricultural Marketing Service.

Services under the Cotton Standards Act—Classing for the General Public for a fee

The United States Cotton Standards Act provides that any person who has custody or a financial interest in any cotton may submit samples drawn in accordance with the regulations of the Secretary of Agriculture to the Department for classification. The regulations of the Secretary provide for the following classifications under this act:

A. *Form A* is the classification or comparison of samples freshly drawn and submitted to a classing office direct from a public warehouse at the request of the owner of the cotton or his agent. Such classification or comparison is evidenced by Form A Memorandum which is subject to review.

B. *Form B* is the classification or comparison of samples submitted by mutual agreement of two or more persons in a dispute. The classification or comparison of such samples is evidenced by a Form B Certificate which is subject to review.

C. *Form D* is the classification or comparison of samples submitted by the owner of the cotton or his agent and is evidenced by a Form D Memorandum which is *not* subject to review.

The fee for each of these classifications is 25¢ per sample for the determination of both grade and staple length. Checks for these fees are made payable to "Agricultural Marketing Service, USDA." Samples may be returned to the owner of the cotton by express collect if such return is requested promptly. Application forms for the services may be obtained from any classing office of the Department.

Services under the Agricultural Marketing Act—Classing Foreign Cotton

A classification and comparison service is provided for samples from cotton produced outside the continental United States. Classifications are made in accordance with the official standards of the United States in effect at the time. The memorandums issued showing the results of such classification or comparison also identify the name of the country in which the cotton was grown and the source of the samples. The fee for this classification is 25¢ per sample.

Services under the Cotton Futures Legislation—Classification of Cotton for Certification on Futures

Cotton futures provisions of the Internal Revenue Code of 1954 provide that all tenders of cotton and settlement therefor under contract shall be in accordance with the classification of the cotton by the Department of Agriculture. Samples submitted for futures certification must be sent direct to the classing office from an approved warehouse. The regulations of the Department provide that the sampling of the bales and the submission of requests for classification are to be handled through the facilities of the Joint Cotton Inspection Bureau of the cotton futures exchanges. The classification results are issued in memorandum form and are also stamped on the warehouse receipt for each bale submitted for classification. Classifications for tender on futures are made at classing offices at Galveston, Houston, New Orleans, and Charleston. Upon written request such classifications are eligible for review by the Appeal Board of Review Examiners.

The fee for classification on futures is 25¢ and the fee for review is 35¢. Micronaire determinations of fiber fineness and maturity are also available upon request to tenderers and receivers of cotton on futures contracts.

Classification of Cotton for CCC Loans on a Fee Basis

A classing service for obtaining Commodity Credit Corporation loans is provided for farmers who are not members of organized cotton improvement groups under the Smith-Doxey Act or who do not avail themselves of the classing service provided under this Act. A fee of 25¢ per sample is charged. Warehousemen whose facilities are approved by CCC for the storage of loan cotton and State and County ASC Offices in the cotton-producing areas can furnish information on the submission of samples for classification. The cotton must be stored in an approved warehouse, an approved farm storage structure, or in certain areas must be under a bill of lading before loans can be obtained. Farmers must make arrangements with the warehousemen, ASC county office, or receiving agency for the sampling of their cotton. Classing offices will bill warehousemen, county offices, and receiving agencies for the classification charges. Checks in payment of such charges should be made payable to "Commodity Credit Corporation." The samples become the property of CCC after classification.

Reclassifications or Reviews Provided under Various Services

Reviews of classification, and in some cases reclassifications, are provided under the various classing services. Information regarding review or reclassification requirements may be obtained from cotton classing offices of the Cotton Division, Agricultural Marketing Service.

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Suggestions for Cotton Classers . . .*

- Each classer should be thoroughly familiar with the range of quality represented by each box of the standards for grade, and by each descriptive grade, and should be equally familiar with the official staple standards. The importance of a thorough knowledge of the official grade and staple standards cannot be overemphasized.

- Before starting work in the morning, the classer should examine the grade boxes and pull a few staple types that represent the range of grades and staple lengths of cotton being classified. Frequent reference to the standards is essential throughout the working day, particularly for samples that are far out of the range of quality of the cotton that is being classed.

- Samples in the grade boxes should not be handled.

- Boxes not in use must be kept closed. Dust, dirt, and exposure to light soon change the appearance of cotton.

- Classers should never use a standard that is obsolete. In all standards boxes, the date of expiration is shown in the lower right-hand corner of the photograph that appears in the cover.

- Whenever possible, samples to be classed and the staple types to be used during the day should be conditioned in the same room before classing begins.

- To preserve their identity the official staple types should be kept in their wrappers.

- When working with cotton samples do not hold or handle them over the grade boxes, as leaf or trash can drop into a box and change the appearance of the samples in the box.

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*Standards have been established and distributed for guidance in classing cotton for grade and staple length. This has done much to promote uniformity of classing, although differences in the results obtained from the classification of the same samples by different classers or by the same classer at different times are not unusual. The suggestions given above should be helpful in reducing the number and extent of variations in making grade and staple determinations.